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ABSTRACT

Thirteen papers submitted to a proposed conference (1986) at Gallaudet College on using computers to teach hearing impaired students are collected in this book. Many papers emphasize the use of word processing software to build language skills. Papers have the following titles and authors: "The Business of Writing: The Special Kids Card Company" (Janice Szablewski); "Word Processing with Mild MHHI (multiply handicapped hearing impaired) Students" (Pamela Luft); "Microcomputers in the Audiology Clinic" (Rosemary Davis); "Children in LOGOland: Personal Learning Patterns" (Francine Bonnier); "Drop Those Pencils! Computers in Writing Development" (Karen Spidal and Gail Ryan); "What's New in NEWSROOM: Software for the Language Arts" (Timothy Sheie and James Hirsch); "Learning with LOGO: A Successful Experience" (Gerald Pollard); "Computers and the Writing Process" (Robert Storm); "RIGHT! RIGHT! Learning English as a Third Language by Computer" (Lee Cooper and Monique Loubert); "When Computers Talk to Videodiscs" (R. Scott Osksa); "Effects of Computer-Assisted Instruction on Comprehension of Abstract Concepts" (Patricia Johnson); "Networking an Instructional Lab and Managing Student Progress" (Cathy Zier); and "Computer-Oriented Prescriptive Teaching of Basic Skills" (David Spidal). (DB)

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YOUR COMPUTERIZED CLASSROOM:

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Using Computers with Hearing-Impaired Students

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YOUR COMPUTERIZED CLASSROOM

Using Computers with Hearing Impaired Students

Foreword by Phil Mackall
Project Leader, Computer Managed Educational Systems
Pre-College Programs
Gallaudet University

Articles by
Francine Bonnier, Quebec
Lee Cooper, Quebec
Rosemary Davis, Cincinnati, OH
Particia A. Johnson, Pikeville, KY
James Hirsch, Anoka, MN
Monique Loubert, Quebec
Pamela Luft, Washington, DC
R. Scott Osksa, Riverside, CA
Gerald Pollard, TX
Gail R. Ryan, White Plains, NY
Timothy Sheie, Minneapolis, MN
David A. Spidal, White Plains, NY
Karen M. Spidal, White Plains, NY
Robert D. Storm, Northampton, MA
Janice B. Szablewski, Pinellas County, FL
Cathy Zier, Atlanta, GA

Edited by Mary Abrams
Pre-College Outreach
Gallaudet University

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Gallaudet Pre-College Programs

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FOREWORD

In 1985, an educational computer conference was held at the Kendall Demonstration Elementary School (KDES) on the Gallaudet University Campus. Offering educators a chance to share their experiences in using computers to teach hearing impaired students, the conference attracted people from 31 states and six countries, and featured 24 different presentations.

Hoping to repeat that success, Gallaudet's Pre-College Programs scheduled a similar conference for the fall of 1986. Unfortunately, that conference had to be cancelled; but a large number of interesting and valuable papers had already been submitted to the conference sponsors. It seemed important to publish and share them, as broadly as possible, with concerned educators. Some of the contributors had submitted accounts of their work in research paper format; these were rewritten as personal "how-to" accounts, making the projects easier to read about and to replicate in other programs. So although the conference did not take place, it resulted in the publication of this book as a practical, hands-on teacher resource.

This collection of articles does not present a comprehensive overview of all the possibilities for hearing impaired students working with computers, but it does serve as a representative sample of the kinds of projects currently going on in the field. Readers will note a heavy emphasis on classes working to build language use with word processing software. That seems to be a true reflection of current trends in the computerized classroom—in schools for both hearing and hearing impaired students. Early classroom computer projects tended to emphasize mathematics, but only a few accounts of math projects were submitted for the 1986 conference. It is clear from the papers used in this book, and from other reports of work in the field, that there remains a strong need for well designed software in other subject areas, such as science and social studies.

Professional journals (*Classroom Computer Learning, Electronics Learning*) also report a growing trend in use of computers to build logical thinking skills. Reviews are mixed on whether the computer is the best medium for sharpening thinking skills; many teachers show equally positive results using other kinds of instructional

techniques. Most educators agree, however, that students—particularly those who are hearing impaired—find computer exercises attractive and highly motivating for work on academic projects and skills training exercises.

For the future, Pre-College plans to continue encouraging schools to communicate about their successes with classroom use of computers. A comprehensive survey of productive classroom projects will be mailed to educators in fall of 1987. The results of that survey will be scheduled for publication within the year, to serve as another resource for interested teachers.

Meanwhile, it is our hope that the many projects outlined in this book—large and small, open-ended or highly structured, designed for students from elementary to high school—will help motivate other educators to investigate the available software, set up their own projects, and get their students seated before keyboards. Many of our authors emphasize the fact that computers offer young people a way to succeed. In the computerized classroom, even students who have had little opportunity for success in the past, can finally enjoy the satisfaction of academic achievement.

Phil Mackall, Project Leader
Computer Managed Educational Systems
Gallaudet Pre-College Programs

THE BUSINESS OF WRITING: THE SPECIAL KIDS CARD COMPANY

By Janice Bobak Szablewski

For more than three years, the Cross Bayou Elementary and Deaf Education Center has had a computer resource lab for handicapped elementary-age students. Some of the students in our program are deaf, others have different kinds of cognitive delays, but all are severely language impaired. A communication disorders teaching team monitors student use of the computers during the school day.

Computers are an important part of the Cross Bayou program. Every student in the communication disorders curriculum routinely receives basic computer instruction, working to master basic skills through computer-based drill and practice and tutorial learning activities.

Language arts and interdisciplinary classes, individual students and teachers move in and out of the lab throughout the school day. Every week more than 120 special-needs students practice reading, writing, grammar, language, and vocabulary skills on the computers.

Let's Go Into Business!

Last year, a group of teachers in the Cross Bayou program (language and speech pathologists, a vocational educator, and a teacher of the deaf) decided to try using the computers as the basis of a student-run business enterprise. Our goal was to motivate students with severe language impairments to work on language, communication, decision making, and socialization skills, while also increasing their competence in word processing. Our assets were a bank of Apple IIe microcomputers, several elementary software utility packages, teacher and student enthusiasm, and a spirit of discovery.

The teaching team decided to sponsor a student company that

would publish greeting cards, using utility word processing software and printers. The products would have to be clear, attractive, and error- free; and the project would provide editorial and economic learning experiences for all the students.

Before we could start the new company, we had to deal with several problems. First, the 16 students selected to work on the project had no experience with word processing and only limited typing skills. Language, writing, and economics were weak areas for all the participants. Finally, we had to meet a two-month deadline, from setting up the company to marketing the final product at a school holiday bazaar.

Table A. Project Goals and Objectives

1. The students will produce a collection of holiday greeting cards using a microcomputer and elementary level word processing utility packages.
2. The students will use language arts skills to write and punctuate correctly the cards they produce.
3. The students will identify the three questions all economic systems must try to answer.
4. The students will define the terms demand, supply, and marketplace.
5. The students will identify at least three factors that may influence the supply of goods and services.
6. The students will define the terms production, producer, and goods, citing examples of each.
7. The students will define the term consumer.
8. The students will cite examples of advertising, identifying specific messages used by advertisers to increase sales.
9. The students will define the term distribution, and will role- play sales situations.
10. The students will define the terms price and profit.
11. The students will form their own company.
12. The students will create products as a group, and market their products at a price determined by the company.
13. The students will create advertising for their product.

Choosing—and Using—Software

Our first task was to turn our Apple computers into word processors that would meet our students' academic needs as well as the requirements of the business. The task seemed easy, in view of the number of creative software applications on the market. We found, however, that many currently available software packages were too advanced for our students to use without weeks of practice. Eventually, we selected *Print Shop* and *Print Shop Companion*. Both packages are menu driven, and require limited reading ability and decision making skills at each step along the way.

Next we had to teach our students how to use the programs. We knew from earlier lab experience that hands-on instruction is most effective. Among the 16 students involved in the project, a few had slightly advanced language capability as well as rudimentary typing skills. Those students were appointed "company foremen."

With little prior instruction, each student foreman was able to use *Print Shop* to create a demonstration greeting card. The students composed, edited, revised, and printed their own copy, testing the various program options and functions. Each card had 1) a greeting, 2) a body or message, and 3) a picture.

After they had learned the basic program sequence, the student foremen began to teach it to their classmates. Soon every member of the group knew how to load the master disk, boot it, and write an appropriate message. Using their original cards as models, the student foremen showed the rest of the company members how to use the basic format as a base for their own words, ideas, and graphics.

Print Shop and *Print Shop Companion* are clearly written and easy to use, and our students had few problems learning how to execute the programs. Confusion was eliminated through trial and error or with the coaching of the student foremen. Students who could not read well were helped by the good readers; kids with spelling problems found classmates to advise them. Everyone was part of the process, sharing skills and ideas.

In only two 30-minute lab sessions, the participants acquired the skills they needed to design and produce the product—custom-made greeting cards. By the third session, all 16 students were easily and efficiently composing and editing text and printing it in greeting card format. Excited by the clean, professional looking product, even the slowest students were willing to expend the effort it took to spell out and type their desired messages.

Designing the Company

The initial learning and experimentation period took only three weeks. With word processing no longer a barrier, the students tackled the next steps—setting up their company, planning the manufacturing process, and designing a sales campaign. It was only five weeks to the bazaar!

The vocational specialist, language and speech pathologists, and special education teacher at our school now began to walk students through the basic principles of free enterprise. The students focused on a variety of economic concepts: supply and demand, the marketplace, distribution, advertising, and investment and profit-making (Table A). Working as a decision-making body, the students chose a company name, the Special Kids Card Company. Then they targeted specific consumer needs, created a product concept to fill those needs, established a system for product sales, and developed marketing strategies.

At last the new company was ready to manufacture its products. The students designed a limited selection of "Holiday-Grams" to be sold at the school's annual bazaar. They voted on specific formats, borders, illustrations, type styles, and messages. Then they used their computers with *Print Shop* and *Print Shop Companion* to create samples of the cards (see Figure 1).

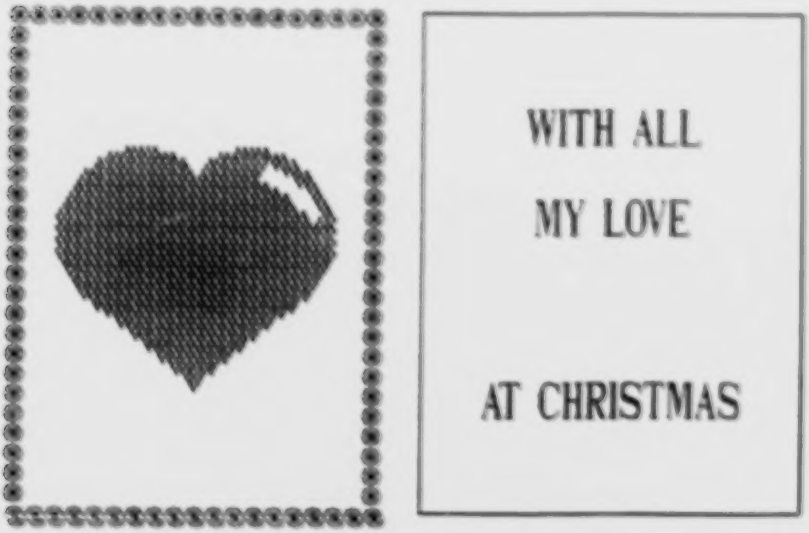

Figure 1. Each student-produced card has an illustration and a message.

Final models for each design were printed on stencils. This made it possible to mass produce the cards on a press, using various colors

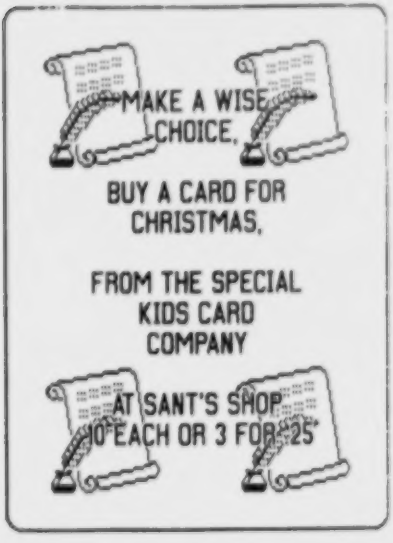

Figure 2. The students also created advertising posters.

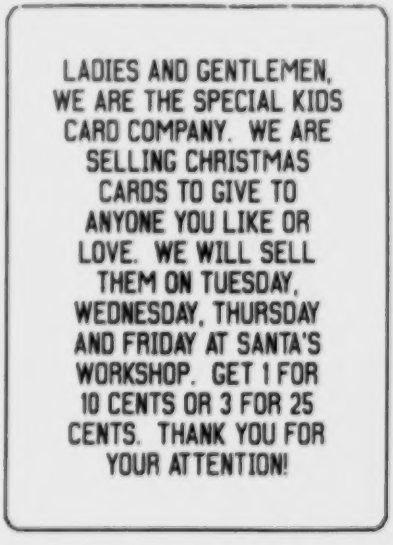
LADIES AND GENTLEMEN, WE ARE THE SPECIAL KIDS CARD COMPANY. WE ARE SELLING CHRISTMAS CARDS TO GIVE TO ANYONE YOU LIKE OR LOVE. WE WILL SELL THEM ON TUESDAY, WEDNESDAY, THURSDAY AND FRIDAY AT SANTA'S WORKSHOP. GET 1 FOR 10 CENTS OR 3 FOR 25 CENTS. THANK YOU FOR YOUR ATTENTION!

Figure 3. They aired their sales pitch in classrooms.

of ink and paper. Groups of students folded, sorted, and readied the finished cards for sale throughout the school.

Without any coaching from their teacher/advisors, the students used their word processing skills to create advertising posters to be displayed in school hallways, classrooms, and offices (figure 2). This was an easy step for the students, because both Print Shop and Print Shop Companion allow users to format text and graphics in a variety of sizes and shapes, including posters, banners, signs, and calendars.

They also used word processing to compose and edit a sales pitch that was aired in classrooms during daily school announcements (figure 3). Finally, they used the banner capability of the programs again to design and decorate their booth for the bazaar. With only a few days left, classroom teachers focused on the math and language skills students would need to sell the holiday-grams at the bazaar.

The project and the business venture were outstandingly successful. Card sales were overwhelming: the company actually ran short

of several popular styles. Students worked together cooperatively and without rivalry, making up for each others' limitations, editing each others' writing, and applauding each others' creativity. They were effective salespeople, aggressively selling their product to the school mainstream of 750 students and staff. Along with new and useful skills, our special-needs students acquired a lot of pride and self esteem.

Fringe Benefits

Many participants discovered for the first time that they could express themselves to others through writing. Sensitive to each others' feelings, they learned to be enthusiastic and caring about their co-workers. Teachers report that the project seems to have stimulated interest in learning. Participating students have been more successful in mastering strategies for reading, writing, spelling, and economics. Overall test and retest data for written language and economic concepts show significant improvement.

Our language impaired students are now taking the initiative in planning their next business venture, one that will use even more complex word processing technology. Last fall, our major goal was the building of academic skills. This time, we can also look forward to increasing our students' desire for learning, encouraging them to explore new areas, and watching them learn how to work cooperatively and creatively with others.

WORD PROCESSING WITH MILD MHHI STUDENTS

By Pamela Luft

Computer-based instruction seems to offer new and exciting opportunities for all handicapped students, particularly those who are learning disabled or hearing impaired. Modifying the educational environment through changes in pacing and sequencing, branching, immediacy of feedback reinforcement, and other adaptive features (Fick, Fitzgerald, and Milich, 1984; Crosby, 1983), can often reveal innate potential among multiply handicapped hearing impaired (MHHI) students. This article reviews the effects of computer use for one student with the dual problems of deafness and learning disability.

A Look at the Literature

Educators seem to agree that use of computers can be especially beneficial to learning disabled students. The literature, however, shows mixed results. In a surprising number of studies, no significant differences are shown between computer aided instruction and traditional teaching methods for handicapped learners (Schiffman, Tobin, and Cassidy-Brown, 1982; Crosby, 1983). Schmidt, Weinstein, Niemic, and Walberg (1986) reviewed 26 studies of computer use with a diverse group of handicapped students. Of the 26 participants, 23 responded positively to computer aided instruction. The researchers concluded that students with language disorders or mental retardation appear to benefit the most.

Reports of computer use with learning disabled students often tend to be anecdotal in nature, without specific control of variables. Despite that fact, most researchers recommend the use of word processing with learning disabled students. They point out that computers can help students relax and enjoy the writing process, leaving more time and energy to spend on creative thinking. (Hummel and Bacon, 1984). Crealock, Sitko, Hutchinson, Sitko, and Marlett (1985) cite other studies that report improvements in the attitudes

of learning disabled students, as well as in the quality and quantity of student compositions. Their own study showed no significant student gains, possibly because it lasted only three months.

Both learning disabled and hearing impaired students are identified as good candidates for word processing instruction (Lederer, Newman, and VanDerBeck, 1985). These students often have great difficulty achieving fluency in reading and writing (Moores, 1978; Russell, Quigley, and Power, 1976). Using word processors for writing makes it easier to enter and revise text, so students can concentrate on the creative aspects of writing.

A national survey of microcomputer use in programs for the hearing impaired (Rose and Waldron, 1984) found language arts frequently identified as a high need area; 48 percent of the programs surveyed used language arts software. Eighty percent of the programs employed drill-and-practice software for their students; tutorial software was used in 67 percent of the programs. Word processing software was not specifically mentioned, and there is no indication of how widely it is used among these programs.

The Study at Kendall School

The group observed in the course of this study consisted of 11 hearing impaired students, ranging in age from nine to 11. All were enrolled at the Kendall Demonstration Elementary School on the campus of Gallaudet University in Washington, DC. The students were grouped into two classes, based on their language and reading skills. All the students were identified as mildly multiply-handicapped.

The specific subject of the study is referred to as Danny. He was chosen because of the nature of his learning disabilities, which caused him extreme frustration with writing tasks. Danny is a white male, born March 7, 1976. The cause of his handicaps is not known, although he showed some jaundice and respiratory distress at birth. He reached all developmental milestones early, except for speech.

Danny's hearing loss was diagnosed when he was two years old. Pure Tone Average on March 13, 1986 was 105 dB in the right ear and 100 dB in the left. His reading achievement, as measured by the SAT-HI on April 1, 1985, was grade level 1.2. WISC-R performance results using deaf norms were 111 (August 24, 1984).

The study was designed to compare two different kinds of

classroom writing—dialogue journal entries and creative writing. The dialogue journal is an ongoing, informal written conversation between teacher and student. Each child in the class is expected to write twice every week in a wire-bound notebook, as a homework assignment. The teacher responds to those messages without correcting any errors in English grammar, spelling, or punctuation. The children then read their teacher's responses aloud, to ensure comprehension.

Creative writing assignments focus on monthly themes chosen by teachers and students. At the end of every month, each class chooses one student composition to be read aloud to the entire intermediate department of the school. Students work on their stories during one to three class periods each week. The classes follow the writing process outlined in the KDES Language Arts Curriculum Guide (see Figure 1).

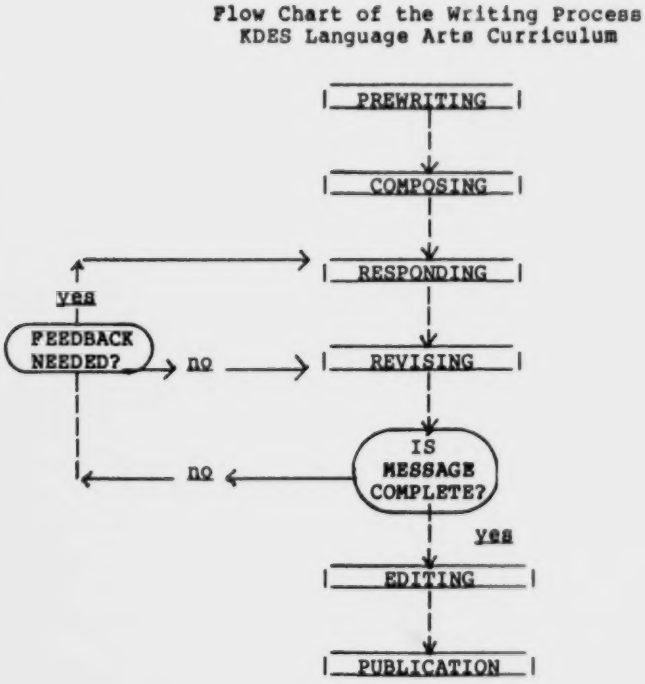

Figure 1. At Kendall School, writing is taught as a step-by-step process.

Danny had had some experience working with computers, largely in the form of games, before being introduced to word processing. In preparation for the new technology, the class discussed rules for using the computer and handling disks. A keyboarding game (Turtle Trot) was used to introduce text entry skills. Danny worked with another student on a combination story-completion and word processing program (That's My Story) for a week before the study began.

Introducing the Bank Street Writer

On March 4, 1986, the teacher introduced the Bank Street Writer word processing program. It was clear that the tutorial for the program was written at a level above the students' frustration threshold. The program is designed for use by writers from fourth grade through adulthood. It can be used effectively, however, without accessing all of its features. Students were shown how to use the "write" mode and the delete and arrow keys to write their stories and correct errors.

After the teacher introduced word processing to the class on March 4, the students did all their composition, revision, and editing on the *Bank Street Writer*. They worked at the computers from one to three times every week. They also continued to write by hand in their dialogue journal notebooks.

A modified multiple baseline design was used to compare Danny's creative writing and his dialogue journal entries. We measured 1) the total number of morphemes within each selection, and 2) the number of S-units: sentence-like combinations of noun plus verb or verb with complement and implied subject. The morpheme count measured the quantity of writing; the number of S-units was used as a gauge of writing quality.

Results of the Study

Table 1 compares the total numbers of morphemes for both kinds of writing. The dialogue journals show rather stable counts during the five-month period, generally varying between four and ten morphemes per entry. A growth curve may have been developing in the dialogue journal writing before the introduction of word processing, but it remained within the four-to-10 range after the class began using computers. The two entries for creative writing in April refer to a story begun in March and finished in April. The higher curve represents the cumulative score; the lower number indicates the work produced in April only.

Table 2 compares the number of S-units in Danny's writing. The dialogue journal counts remained quite stable, varying between none and two for all but two entries. The S-unit counts for Danny's creative writing show an upward trend, again with an unusually high peak in April.

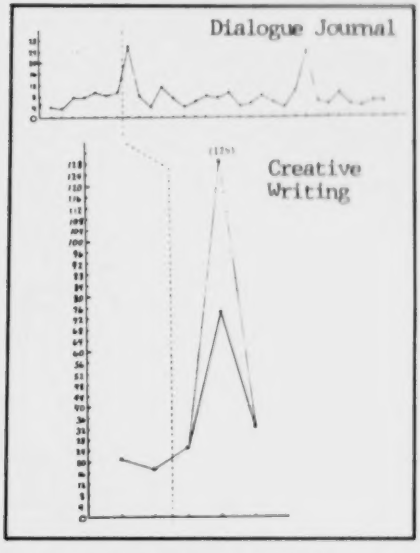

Table 1. Number of morphemes in Danny's writing.

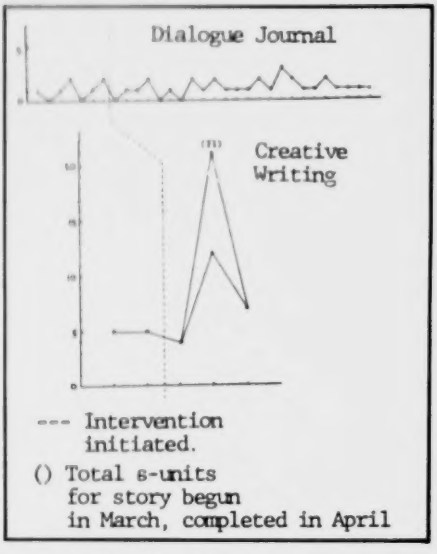

Table 2. Number of S-units in Danny's writing.

The class had worked on their creative writing only twice before the study, so they had not established a reliable pattern of accomplishment. While the introduction of word processing technology seems to have had a positive influence on Danny's creative writing, that effect did not generalize to the dialogue journals.

What Does It Mean?

A number of uncontrolled variables might have influenced the data that appear here. The goal of any instructional activity is to demonstrate measureable growth, but this does not appear to have happened with the dialogue journal entries. Danny's consistently brief entries may be his response to the conversational format, or may indicate satiation with the medium. Because he was involved in two different kinds of writing assignments, Danny may have put more of his energies into the creative writing tasks.

The improved scores for creative writing may indicate only the aca-

demic growth that might be expected from any kind of educational activity. The creative writing data reflect the total of Danny's cumulative work during each month of the study. Occasional patterns of high or low achievement may have been lost in recording the entire month's work as a single unit. Any dramatic increase would be the result of consistent effort over an extended period of time.

These data are not sufficient to reflect the teacher's perceptions of change in Danny's behavior. He showed progressively increased motivation and reduced frustration during the study. The scale rates Danny's level of participation in a variety of writing tasks. The teacher also chose relevant excerpts from anecdotal observations on his progress with the creative writing/word processing assignment. His dialogue journal writing could not be similarly rated, because it was done at home. The participation scale and anecdotal summaries appear below.

Participation Scale

+4 Begins work on task independently.
+3 Is eager to work on task.
+2 Enjoys working on task.
+1 Is involved in task.
0 Works when directed.
−1 Ignores directions and encouragement.
−2 Responds negatively to directions and encouragement.
−3 Responds to directions and encouragement with hostility.
−4 Refuses to do task.

Anecdotal Summary

January (−2) Subject evidenced frustration; cried for 15 minutes. He resisted any help unless he had specifically asked for it.

February (−3) Subject copied a story from a magazine, resisted writing his own story. He withdrew to the back of the room and cried. He began writing, then crossed it out and wrote a large "NO" at the top of his paper.

March (+1) Subject began a story on the computer about the month's theme, then wrote another story. Finding all the computers in use, he began a third story on a typewriter near the computer station.

April (+3) Subject added extensively to his second March story.

Despite its length, he edited it largely by himself. He tried to be first on the computers.

May (+4) On May 19, subject seated himself at the computers before school began. The class had scheduled other activities; Danny cried when told he couldn't use the computers that morning. He soon joined the class, but worked on his story during recess.

The teacher notes indicate a clear pattern of change in Danny's attitudes toward and participation in creative writing, from negative to positive. He persevered in writing assignments that continued for several weeks at a time, one to three times every week. Again, these data summarize entire months of activity. Specific information on each session at the computer use would illustrate the patterns of change more completely.

Recommendations for the Future

This modest study suggests that use of a word processor for creative writing can lead to positive results for hearing impaired students with additional disabilities. On specific measures of writing quality and quantity, Danny showed increasing competence in creative writing. Those results, however, did not generalize to a handwritten writing task. More studies are needed to measure performance over a longer period of time and to document accurately any strong patterns of change. Finding a way to measure attitudinal and affective change might also help educators assess the effects of word processing for this kind of student population.

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MICROCOMPUTERS IN THE AUDIOLOGY CLINIC

By Rosemary Davis

Much has been written about the usefulness of computers as administrative and clinical tools. Quite justifiably, other writers warn that computers are *not* the answer to *all* problems. The computer's value lies only in its ability to solve specific problems. On that basis, many audiological clinicians who work with young children have found them very useful indeed.

Uses in Audiologic Evaluation

The ongoing challenge for audiologists working with young children (age two to five) is keeping them interested in the training activities long enough to obtain reliable test scores. Conditioned Orientation Response (COR) and play audiometry are helpful in allowing professionals to obtain initial auditory responses. As with any kind of repeatable stimulus, however, children may become bored with the activity after a few repetitions. After all, one can only wave to the monkey, put the ring on the spool, or pop the marble into the can so many times! Anyone who works with young children over a period of time knows that the amount of information obtained from a child is often directly proportional to the tester's creativity.

Microcomputers allow the auditory conditioning activity to be retained for consistency, while varying the visual stimuli so that the task is more interesting and fun for young clients. Another advantage of using computers as testing tools is that visual stimuli can be tailored to the specific needs or interests of each child. Since children respond better to different kinds of visual stimuli at different ages, programs can also be designed with different levels of motor and visual challenges.

Arranging the Equipment

Testing equipment for audiologic evaluations can be arranged in

two different ways, depending on the age of the child, the number of participating clinicians, and the size of the test suite. (In the following descriptions, the clinician in the control room will be referred to as the "controlling" clinician; the clinician in the test room as the "assisting" clinician.)

Equipment Setup #1

Apple IIe, IIc, or II + with 48K memory minimum and 80-column card
One or two disk drives
Color monitor
Joystick or game paddle
Standard video input/output cord.

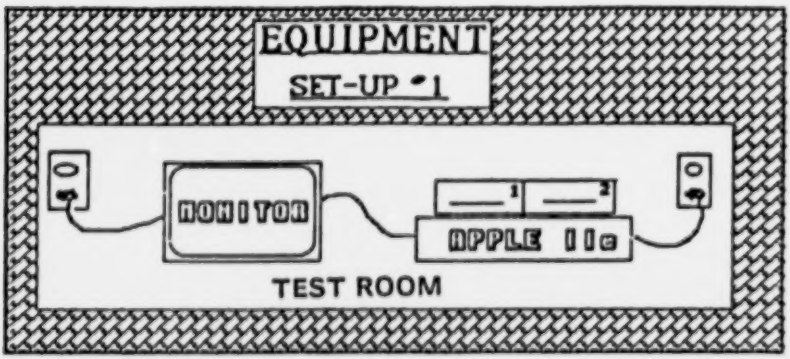

Figure 1. This basic setup requires two clinicians—one in a control room, another in the testing area.

The computer and monitor are located in the test room with the child and an assisting clinician. The child sits in front of the monitor; the clinician sits in front of the computer keyboard (Figure 1). If a joystick or game paddle is to be used, it is placed in front of the monitor for the child. The assisting clinician in the test room controls the program sequence.

Equipment Setup #2

Apple IIe, IIc, or II + with 48k memory minimum and 80-column card
One or two disk drives
Color monitor
Joystick or game paddle
Two 6-foot video input/output cords
Two 1/4-inch phono-plug adapters (available at most local electronic supply stores).

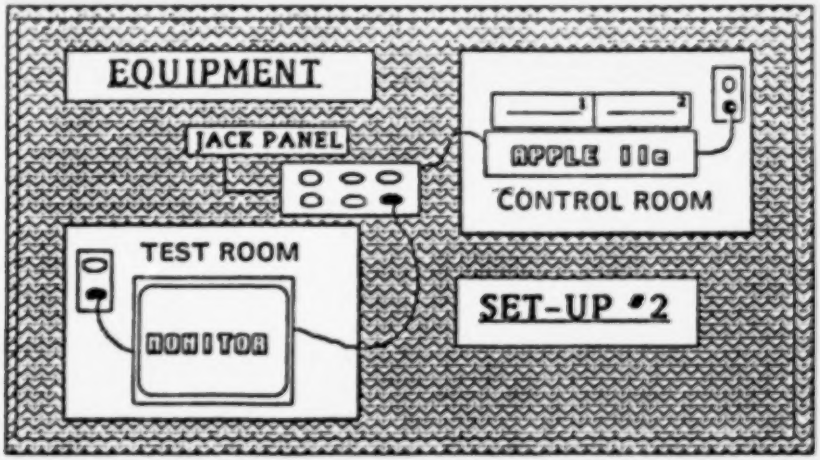

Figure 2. This arrangement works well for one clinician working with an older child.

The computer keyboard is located inside the control room beside the audiometer, and the monitor is in the test room with the child (Figure 2). The computer is connected to the monitor through the jack panel, using the phono-plug adapters and video input/output cords. The clinician in the control room manipulates the program sequence.

Equipment setup #1 is used when two clinicians are available to work with the child—one in the control room and one in the test room. Equipment setup #2 is used when only one clinician is working with the child; for instance, if the child is old enough to work alone or with a parent in the test room.

Positioning of the monitor in the test room is important for sound-field testing. If only one monitor is used, it should be placed on a small table equally distant from the two speakers, when both speakers are to be used during the session. Otherwise, depending on the size of the test room, the monitor can be placed approximately three feet in front of the single speaker to be used. If headphones are used, the monitor can be positioned anywhere along the length of the headphone cords.

Program Development and Use

Computer graphics used in audiologic evaluations of children are not designed to replace familiar testing procedures, but to expand

the capabilities of those procedures. Standard behavioral testing procedures for play audiometry are used: that is, the child's response to a sound stimulus will remain the same for each presentation. The visual reinforcer, however, changes with each presentation. Both the response and the visual stimuli can be changed to match the child's chronological or mental age, as in the following examples.

Ages Two to Three-and-Half

Children in this age group respond well to bright flashes of color, completed pictures, or simple animation. Computer graphics designed for this group should be kept relatively simple, and equipment setup #1 is usually preferable. The child sits in front of the monitor; the assisting clinician sits in front of the computer keyboard. The computer is controlled by the assisting clinician in the test room. Sound is regulated by the controlling clinician at the audiometer in the control room.

As in play audiometry, the controlling clinician begins tonal presentations, generally using the ascending method. When the child reacts to a tone, the assisting clinician takes the child's hand and gently slaps the monitor with it. As soon as the child's hand hits the monitor, the assisting clinician also presses the space bar or game paddle button and a bright burst of color appears on the screen. The color stays on the screen for six to eight seconds and then disappears. When the child reacts to another tone at the same level, the assisting clinician repeats the conditioning activity. Each time the child slaps the monitor, a different burst of color appears.

Most children can perform this conditioned activity by themselves after two or three demonstrations. If a child slaps the monitor when no tone has been presented, there is no visual stimulus. Very few children at this age level continue with false-positive responses if they receive no visual reinforcement for their efforts.

When the child tires of simple flashes of color, brightly colored pictures can be substituted. The conditioned activity—slapping the monitor—remains the same. Simple animation included in the pictures is a strong reinforcer (e.g., a birthday cake with flickering candles, moving hands on a clock, a cat with "shifty" eyes). As with the color bursts, the picture stays on the screen for a few seconds and then disappears.

Animation used for this age group should remain simple—only one area of the graphic should be programmed for a given picture. Chil-

dren's responses do not seem to be as consistent for as long a period of time if there is a great deal of activity on the monitor.

Ages three-and-a-half to six

Children in this age group respond well to "picture-building" activities or to simple game formats. Like younger children, they also are delighted by simple animation. Using equipment setup #1, seat the child before the monitor. Children older than four-and-a- half can usually manipulate programs by pressing a button on the game paddle. The hand-slapping activity works better with younger children, who may not have the fine motor skills necessary for pressing buttons. The assisting clinician handles the game paddle.

Using standard play audiometry techniques, the controlling clinician starts presenting tones. When the child hears a tone, he or she reacts either by pressing the button on the game paddle or signaling the assisting clinician to do so. In response, part of a picture appears on the monitor.

Each time the child hears a sound and presses the button, another piece of the picture appears. In this way, the child builds a picture from a series of "puzzle pieces." If the child pushes the button when no tone has been presented, the picture is wiped from the monitor and the child must begin building the picture from the beginning again. Most children learn this activity very quickly, because they are curious to see the completed picture.

A few children show frustration when the picture is eliminated. If this occurs, the assisting clinician should maintain control of the joystick, and the child can be given a dummy paddle. When the child presents a false-positive response, the clinician simply gives no additional visual stimulus.

This age group also responds positively to simple game situations using animation. In one such game, the screen shows a small dog on the left side, a doghouse on the right side, and a connecting path between them. The object for the child is to put the dog in his house. The child hears a tone, presses the button on the game paddle, and the dog jumps one space closer to the doghouse. When the dog finally reaches "home," he receives a bone and wags his tail. False- positive responses may be discouraged by returning the dog to his beginning position, or by using the variation described for the picture-building stimulus.

Ages Six-plus

Children in this age group also enjoy the picture-building activities and simple animated games that are effective with younger groups. One advantage of working with older children is that they can perform the activities independently. Equipment setup #2 is generally used successfully with this age group.

Uses in Auditory Training

Equipment setup #1 can also be used for auditory and speech training activities. The clinician sits beside the child, controlling the computer; the monitor is in front of the child. The following example describes a program developed to aid in the auditory and speech training of severely hearing impaired children ages three through five. Simple block formations represent the different skill levels used in the Ling Method of speech training: repetition, duration, intensity, and inflection.

Brightly-colored blocks are manipulated in various patterns on the monitor to represent the specific speech patterns being practiced. Each color represents a different vowel sound being used in combination with a consonant sound: e.g., red = a, blue = u, and green = i.

The number, sizes, and positions of blocks on the screen give visual information about characteristics of the sound. Three blocks on the screen represent three syllables (ba, ba, ba); two blocks represent two syllables. A square represents a sound of short duration (da); an elongated rectangle is a sound of longer duration (daaaaaa). Large blocks represent loud sounds; small blocks represent soft or whispered sounds. Blocks appearing in ascending or descending patterns give information about the inflection pattern of the target sound.

This series includes eight different programs. Depending upon the age and skills of the child, programs can be selected for specific skill levels. The programs are designed to represent visually the target syllable (the clinician's utterance) and the child's response on the monitor at the same time. If the child imitates the target sound correctly, his pattern will match the clinician's. For example, the clinician's three-syllable repetition of /ba ba ba/ is represented by three red blocks across the top of the screen. If the child imitates these target syllables correctly, then three more red blocks will appear underneath the clinician's presentation.

For a stimulated pattern of /ba bu ba/, the screen would show a red-blue-red block pattern. When the child imitates the target syllables,

the clinician presents the actual response on the screen. If the child responds to the /ba bu ba/ stimulus with /bu ba/, the screen pattern would show one blue and one red block.

In other words, the screen will show representations of both the clinician's and the child's utterances. If the child's response is incorrect, a combination of auditory, visual, and motor stimuli (taking the child's hand and following the pattern on the screen) can be used to encourage correct production.

Strong reinforcement for correct responses is provided by colorful, animated graphics presented at the end of each program sequence. If the child's production is incorrect, the clinician can erase the program from the monitor (after discussion of pattern differences—design, color, size, and placement on the screen) and begin again.

In using this type of program, it is important to be cognizant of the child's visual skills. Because the program is based on color coding of sounds, color blindness might limit its use with some children. It is advisable to try color-matching activities with children who will use this program to be sure that they can recognize color differences. They also need to understand the meanings of same and different, two concepts intrinsic to this activity.

Advantages and Disadvantages

Computer graphics can be a powerful clinical tool when used in audiologic evaluation and auditory or speech training with young children. Most young clients seem to have a longer attention span for computer activities, and to work at more intense levels of concentration. They often achieve a high consistency of responses in a very short period of time.

For hearing-impaired children who are tested frequently, computer graphics can be a welcome alternative to conventional play audiometry routines. Aided thresholds can, of course, be tested just as reliably as unaided thresholds.

Cost is still a major deterrent to the extensive use of micro- computers in audiological testing. Most clinical facilities cannot justify purchasing computer equipment for clinical use alone. In some clinics, one computer is used for both clinical and administrative applications. When it is needed in the clinic, it may be removed from the office, reassembled in the test room before the session, and later disassembled and returned to the office.

Thus it becomes extremely inconvenient for many testing facilities to use their microcomputers for testing. Clinicians who are fortunate enough to work with these versatile machines are only beginning to understand the possibilities of computer graphics as a reliable and useful resource for working with young children.

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Computer Software

It's Kids' Stuff, 7226 Cobblestone Ct., Cincinnati, OH 45244
Package 1 — Auditory and Speech Acquisition
Package 2 — Audiologic Evaluation (Age 2 - 4)
Package 3 — Audiologic Evaluation (Age 3 ½ - 6)
Package 4 — Audiologic Evaluation (Age 3 - 6)

Baudville, Grand Rapids, Michigan
"Blazing Paddles" (Graphics processor)
"Pixit" (Graphics processor)
"Take 1" (Animation graphics)

CHILDREN IN LOGOLAND: PERSONAL LEARNING PATTERNS

By Francine Bonnier, Ph.D.

What happens in "Wild LOGOland?" Last year an educational researcher in Quebec wondered how a group of deaf children would manage if they were allowed to work with computers and LOGO software on their own, without training in basic computer skills, without specific assignments to complete, and without established goals or objectives.

Setting up a LOGOland Situation

A research project (RELIE) was designed to find answers to those questions. The project was conducted at L'Ecole Gadbois, a total communication school in Montreal. It was sponsored by the Ministry of Education of the Province of Quebec. The researcher arranged for 23 deaf children, age seven to 13, to work with LOGO three hours per week for six months, in a non-structured environment.

Students in four different classes—grades one, two, four, and six—came with their teachers to work in a computer lab, three times each week. All of the children used LOGO software. Although a few of the children had some previous experience with LOGO, none had received formal instruction, nor was any given during the course of the project. The available equipment consisted of three Apple IIe computers, one MacIntosh, one Texas Instrument, and four printers. The printers were programmed to record every instruction entered by the students who worked on the Apple IIe computers. The children were observed and their drawings, printed protocols of their work, and the observations were analyzed.

The children were encouraged to experiment by themselves and to choose their own approaches to the computers. One might antici-

pate that without overall direction or instruction in basic skills, the students would waste their time on the computers and learn very little from the experience. The project was based, however, on a belief that the children would develop spontaneous, natural work processes.

Finding The Patterns

What happened in "Wild LOGOland?" An initial analysis of the children's protocols shows that every one of the 23 participants found a way to work in a structured and focused manner. They chose many different approaches, but none worked haphazardly. Every child established personal thinking schemes for dealing with the computers, then continued to use those patterns consistently. Their personal patterns helped the students shape their thoughts, find answers to questions, and react to whatever happened on the screen.

A pattern is a simplified model of a structure. For this project, a pattern is defined as a personal, deliberate, repetitive manner of choosing keys, digits, or primitives to act on some component of the computer environment (screen, turtle, disk drive, printer, etc.). A pattern may also be a specific way to give instructions, build procedures, organize or save one's work, or cooperate with others.

An analysis of the children's activity reveals various patterns of work that may be classified into five major categories.

1. **Patterns modeling the choice of digits.**
2. **Patterns modeling the actions the child decides to undertake:**
   - Getting acquainted with the keyboard, the turtle, etc.
   - Exploring, searching for new ideas.
   - Trying, experimenting, aiming at an objective.
3. **Patterns modeling a reaction to LOGO feedback:**
   - Responding to a LOGO message.
   - Debugging a program.
   - Starting over.
   - Trying something else.
   - Checking one's work.
4. **Patterns modeling the keeping of one's work:**
   - Copying work.
   - Taking notes.
   - Following procedures.
   - Saving work.

- Printing work.
- Using files.

5. **Patterns modeling the social organization of one's work:**
   - Starting or ending a task.
   - Cooperating with others.
   - Seeking help.
   - Helping others.

Patterns of Digit Selection

One of the first facts that emerged from the study was that none of the children chose digits at random. On the contrary, each child set up relatively precise patterns of digit selection that remained extremely stable during the full six months of the study.

For example, Karin, age 7, seemed to choose randomly, but in fact, she always picked two digits—the first from the center of the keyboard and the second from one of the edges. She never repeated the same digit, or chose two consecutive digits. Similarly, Karin also seemed to be selecting primitives at random. After observing sequences of four, eight, or 12 instructions, the researcher noted that she used each of the four basic primitives (forward, backward, left, right) an equal number of times. Karin's technique enabled her consistently to create interesting and varied designs.

Robert, age 7, formed all of his numbers with the digits 9 and 0. His numbers always started with 9; depending on what he needed, he would add another 9 or a 0. To move the turtle a short distance, he would strike a single 9. For a slightly longer move, he typed 99 or 90. If he wanted the turtle to move a great distance, he typed 999, 990, 900, or 9999, 9990, 9000. Using his pattern, Robert quickly managed to discover and utilize 90-degree angles. By consistently using the 9 for short moves, and alternating the primitives 'forward' and 'right,' he learned how to make circles.

Evan, age 12, preferred to build his work on multiples of 10. When he needed to refine a move he used divisors of 10: 1, 2, or 5. When he wanted to repeat a distance or angle command, he reviewed his earlier entries mentally or on paper to preserve the same instruction.

In a similar manner, each child in the program established personal patterns of operation. Most of the students set up several different patterns for choosing digits and tended to select the most appropriate, depending on what they wanted to accomplish.

The Pleasure of Seeing Things Happen

The children developed other types of patterns to use for exploration. Often, a child sitting at the computer would appear to be working without method or structure. Upon examination of the work, however, we found that even those who seemed to have no specific objective were proceeding very systematically.

Nancy, age 7, developed a precise method of exploring files and procedures. She would type the word 'catalog,' then 'load' and a file name. She typed the same file name to execute the procedure. After doing this several times, Nancy would clear the screen. She often repeated the pattern 10 to 20 times during every computer session.

Within that broad pattern of exploration, Nancy also learned how to explore a given procedure to create interesting patterns on the screen. She would ask for the procedure at least twice. If the design was not what she wanted, she would clear the screen and retype 'catalog.' If the design was pleasing, she might repeat the procedure several times. She might change the color of the pencil or the screen, ask for her procedure again, change the color again, and wait to see what would happen—as many as 50 times in a session.

Nancy preferred to create colorful and interesting textures, rather than figurative drawings. When she found an effect that she wanted to keep, she would either print it right away or continue her exploration and print it later. When she finally was ready to print, Nancy did not refer to the written record of her previous work, but was able to reproduce her steps quite accurately from memory. Her pattern of exploration, which originally seemed to have little purpose, now had a definite objective—to recreate a specific effect on the screen.

Sarah established an interesting system of reacting to LOGO messages on the screen. Her pattern worked effectively for her, and offers important insights into the thinking processes of a deaf child. Sarah was 10 years old and in her fifth month of work in LOGOland when the following exchange took place. Working by herself, she had just finished a drawing that looked like a window.

Sarah: To window
LOGO: Window is a primitive
Sarah: To window
LOGO: Window is a primitive
Sarah: I do not want a primtive
LOGO: I don't know how to I

Sarah: Do not want a primitive
LOGO: I don't know how to do
Sarah: Not want a primitive
LOGO: I don't know how to not
Sarah: Want a primitive
LOGO: I don't know how to want
Sarah: To window with squares
LOGO: Window is a primitive
Sarah: Load "triangle"

Sarah's pattern of responses to LOGO consisted of the following steps:

1. She reads the message and repeats the instruction, indicating that she does not understand the message and wants to review it.
2. She reads the same message again and answers in a logical, verbal way, telling LOGO what she does not want.
3. She reads another message and again responds logically, taking out the word LOGO reacts to.
4. She then tries a different, more precise solution, asking for a window with squares.
5. When that doesn't work, she asks for something she knows will work—Load "triangle."

What does this exchange tell us? First, it indicates how deeply Sarah was involved in her task. She read the LOGO messages quite well, picking up clues for her responses, a task she could not have accomplished during her first few months of LOGO work. She did not ask for help, but tried to find an answer for herself.

At one level, the exchange did not appear to accomplish much. Sarah did not know the LOGO language well enough to understand the term 'primitive.' She did not succeed in getting LOGO to do what she wanted. But she did learn that the word 'primitive' exists, and spelled it correctly the second time she used it.

From an internal, psychological point of view, the exchange demonstrated Sarah's very structured way of reasoning with the computer. She undertook to find answers by herself, trying several solutions within one category before going on to something else. She also demonstrated the ability to cope quite easily with verbal problems.

A Pattern of One's Own

Some of the children in the study used several different patterns for dealing with the computers; others used only a few. Some students

knew and understood the use of primitives; and some were more advanced in their personal and intellectual development. But whether they were six, 10, or 13 years old, familiar with the computer or not, all of the 23 children developed patterns of their own and used them consistently in their LOGO work. Some of the patterns seemed similar, and occasionally one child would copy and use another's methods for a while. But when they really wanted to work on their own projects, all of the children reverted quickly to their own patterns.

The LOGOland experience seems to indicate the importance of patterns in the learning process, particularly for deaf children. In this nonstructured situation, the students learned to control what happened on the screen. They discovered that computers were not magical objects, but machines that would respond to meaningful directions.

When children develop their own patterns, they create reference points that allow them to verify their actions, predict what will happen, and maintain some control over future results. Because children tend to repeat activities, they can compare similarities and differences. Building their own patterns can help give children a structured way of working that fits their own thinking, their levels of functioning, their perceptions and feelings.

The message seems clear—given a chance (unstructured time on the computer) and motivation (the fun of seeing the computer respond), children are likely to establish their own methods of exploring and dealing with the problems at hand. Children often do better when they are allowed to find answers to important questions in their own way; learning patterns should not be imposed from above.

DROP THOSE PENCILS! COMPUTERS IN WRITING DEVELOPMENT

By Karen M. Spidal and Gail R. Ryan

During the relatively short time computers have been used in the educational program at the New York School for the Deaf, the staff has come to value them as important educational tools. Beginning in the fall of 1985, all middle school and some high school students have had access to computers with word processing software.

Initially, computers were used primarily for typing and keyboard practice and to copy papers that had already been written and corrected by hand. Thus two of the most exciting word processing capabilities—writing and editing—were not used by most classes.

On Students and Writing

Students often dislike writing assignments because necessary revisions and corrections can only be made by rewriting the entire paper. Using the computer for creative writing simplifies the task of revision. An educator in Minnesota reports, ". . . not just revising is simpler, it seems. Videotapes of the process record that these students find the whole writing process easier on a computer" (Solomon, page 41).

Using computers, students are less frustrated by the writing process: mistakes are easily corrected, and the finished document may be printed as many times as necessary. Dr. Teresa Rosegrant says, "Instead of sharing frustrations, the children begin sharing their texts with others to read" (Rosegrant, page 114).

The process of writing itself is a major topic in educational circles. There seems to be a shift away from teaching writing as a product. Instead it is being taught as a process (Hairston, 1982). John Dewey preferred that students be "active learners" (1916). He felt

that students should experiment by manipulating objects—in this case words, sentences, and paragraphs—in order to communicate.

James Britton believes it is important that "... children in school should write about what matters to them to someone who matters to them" (Britton, et al., 1972, page 53). Rote learning is no way to teach writing. The teacher's role should be that of a facilitator, rather than of an instructor dictating a step-by-step formula for writing.

Donald Graves has also done extensive research into the writing process. He lists five important subprocesses: prewriting, writing, conferencing, revision, and final draft or publication (Graves, 1983). Students may not be ready to take these steps in rigid sequence, but should develop their own ideas for writing. The teacher should be a partner and collaborator, encouraging their efforts.

- In the prewriting phase, the teacher and students, or students alone, can brainstorm ideas on topics of their choice. Meaningful topics often evolve from storytelling sessions.
- The writing phase should use the computer for a free flow of ideas. Grammar and syntax are not priorities at this phase.
- During the conferencing phase, students can discuss each others' compositions, or consult individually with a teacher. The teacher should use good judgement at this phase, suggesting changes and improvements without discouraging young writers. For instance, when a student feels that a composition is finished and wants to stop working on it, the teacher must decide whether to urge additional revisions or to accept the paper as it is.
- Revision is done next, after students have discussed their work with the teacher or with each other. When the student and teacher agree that the composition is completed, it is time to print the draft. The neat, finished look of a printed document is a great source of pride for most students.

Setting up a Writing Project

In 1985, four classes at the New York School were chosen to participate in a pilot writing project. They included a class of third grade students from the lower school, a fifth/sixth grade class from the

middle school, a seventh grade reading and language class from the high school academic program, and a special class of eighth and ninth grade students from the alternate high school program. The project was monitored by Gail Ryan, curriculum coordinator for the school, and Karen Spidal, coordinator of computer programs.

Each group devoted three 42-minute periods every week to the writing project. The classes were held in two computer labs; each student had access to an Apple IIe computer, and they shared the three available printers (Imagewriter and Epson). The word processing program most often used was *Bank Street Writer*. Each student kept a personal disk containing all of his or her work, and a file for hard copies of the writing. A selection of books and materials was kept on hand to suggest writing topics.

Early in the program, the students learned one or more of the word processing programs, with particular emphasis on keyboarding skills for those who had not completed the basic courses. There was a regular writing routine for each class session.

1. An introductory lesson included teacher modelling, brainstorming, role playing, and other techniques for building ideas.

2. Students wrote at their computers.

3. Students discussed their writing with a teacher or other students. The conferences included suggestions for revisions and editing.

Students chose to write about a wide variety of topics, including people (family members, teachers, clowns); foods (chocolate-covered ants, favorite foods); social issues (equal rights, freedom of choice); transportation (busses, cars, *Chitty-Chitty-Bang-Bang)*; personal history (my twin, where I used to live); adventures (a trip to the moon, the zoo, cave exploration). They also wrote about hobbies, jobs and careers, sports, and television shows.

At the end of the project, participants shared their completed work with others via class conferences. The papers were collected for a publication that was placed in the campus library.

Project Goals and Evaluations

Three major goals were selected to meet student needs and to comply with the stated goals of the regular school curriculum. The

project directors also wrote evaluation statements to accompany each of the goals, as follows:

1. **Students will increase their ability to use and analyze expressive language through the writing process.**

   A. Writing samples will be compared at the end of each quarter of the school year, using these criteria:
      - Length of composition.
      - The use of sentence patterns and extended sentence patterns.
      - Proper use of syntax and grammar.
      - Use of complex words and complete phrases.
      - Use of punctuation.
      - Students' sense of competence and teachers' estimates of student progress.

   B. Similar types of stimuli will be used for the writing to be evaluated each quarter. These may include similar pictures or stories to suggest writing topics.

   C. Comparisons will be made in September and June, using writing samples taken from project participants and a control group of nonparticipating students.

   D. Speech teachers in the lower and middle schools will administer a standardized test to measure increases in student use of expressive language.

2. **Students' writing development will be recorded in their files and discussed with administrators and parents.**

   A. A form containing a review of the writing achievements of each student will be completed and sent to parents along with paper copies of their children's writing. The report forms and writing samples will also be reviewed by the supervisor and the principal.

3. **Students will increase their awareness of computer technology and its career potential.**

   A. An informal, observational evaluation of computer awareness and competence will be completed by classroom teachers.

Results of the Project

At the beginning and the end of the school year, student project participants were given sets of pictures and asked to write about

them. Lower and middle school students received three pictures each; high school students had six pictures to work with. Other students of similar ages and grade levels, who had not been part of the project, were asked to complete a similar writing task. Students in the pilot study used word processing; the other students wrote with paper and pencil. Then the finished writing of the two student groups was compared, using the evaluation statements listed for Goal 1.

All of the students wrote longer compositions in June than they had in September. The students involved in the project increased the length of their writing considerably more than did the control group. The project group used more sentence patterns as the year progressed; this was less true of the nonparticipants. Few differences were noted in the students' use of correct syntax, punctuation, complex words and complete phrases.

The teachers involved in the project noted that the participating students seemed to take greater pride in their writing. They often asked for copies to take home for their parents, or to display in their classrooms.

Goal 2 specified that students' writing should be recorded, reviewed, and shared with administrators and parents, using a review form and copies of writing samples. The formal review process took place only once, near the end of the school year. On an informal basis, however, school supervisors and administrators frequently reviewed samples of the students' writing, and participating students took home copies of their work throughout the year.

Student awareness of computer technology and its career implications was not formally measured. Classroom teachers, the curriculum coordinator, and the coordinator for computer programs noted, however, that students displayed growing knowledge of parts of the computer, word processing jargon, and the capabilities of word processing systems. This learning did not result from formal instruction, but from routine use of the computers.

Implications of the Project

The success of the program led to discussions of how this kind of project could be offered to other students in the New York School for the Deaf. Last spring, a full-day writing workshop was held for teachers to discuss the process approach to computer-aided stu-

dent writing. The results of the computer writing project indicate clearly that hearing impaired students should be encouraged to use word processing for their writing assignments. They tend to enjoy using the computers, show greater pride in their work, and write more than students who use traditional writing methods.

It is also clear that students would benefit from having more time to work with the computers. Several improvements in student writing were noted during the school year, but in other targeted areas, few changes seem to have taken place. It seems likely that the students would also have improved their use of syntax, punctuation, complex words and phrases if the project had continued longer.

Based on that perception, the project was repeated during the 1986-87 school year, and will probably be continued for at least a third year.

Incidental Findings

During the first year of the writing program, the teachers and monitors became aware of several results that were not directly related to the goals of the project. At least two adults were stationed in the computer lab while students were working, to answer questions and offer help as needed. Students tended to demand assistance immediately so that they could get on with their writing. They seemed reluctant to wait for help.

It also became clear that keyboard skills are a prerequisite to word processing on the computer. Students who did not enter the program with keyboarding skills were frustrated by their slow progress in writing on the computers.

The teachers involved in the program also found that most students would reach a point of closure, when they were no longer willing to continue working on a particular piece of writing. The teachers learned to accept the students' frustration with revisions, rewriting, and editing, and to respect their feelings that "enough is enough."

In summary, four classes of students used computers three times each week for writing composition, editing, and revisions. The students used Apple IIe computers, compatible printers, and word processing software—primarily Bank Street Writer, keeping their work on personal disks.

Writing samples analyzed at the beginning and end of the project indicate that participating students' writing increased in length, as well as in number and variety of sentence patterns used. Students made limited improvements in their use of punctuation and complex words and phrases. Teachers noted that students began to take increased pride in their work, and that the quality and quantity of their writing improved during the year.

The project is now in its second year. The educators involved anticipate additional improvement as students continue to work with computer word processing.

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WHAT'S NEW IN NEWSROOM: SOFTWARE FOR THE LANGUAGE ARTS

By Timothy P. Sheie and James Hirsch

The use of computers in the education of hearing impaired students is a rapidly evolving educational tactic. Schools may have difficulty locating high quality software; the software is often too expensive for the school budget; modifications may be necessary—and impossible. In view of those conditions, *Newsroom*, a well designed software tool for teachers, seems to have appeared at an opportune time.

The authors of this article represent two different specialties— secondary math and special education technology. We have worked together to develop materials and share technical information, as well as on the writing of this article. We both work with hearing-impaired students in different kinds of classroom settings.

Educational Background

In 1981, the Anoka-Hennepin Public Schools (in the northwest Minneapolis suburbs) began a computer-based photo-journalism project in a mainstream resource program for hearing impaired students. The project was designed to integrate computer technology with the language arts curriculum. The program focused specifically on content, ignoring distinctions between disciplines in an attempt to encourage innovation and the implementation of new ideas.

One of the goals of the project was to encourage mainstreamed hearing impaired students to write factual information. There was also strong impetus for language tutoring; direct, appropriate instruction; and remedial work. The use of *Newsroom* software with both hearing and hearing impaired students was a logical outgrowth of that two-year project, which relied on the appeal of two highly motivating media: microcomputers and photography.

Enter NEWSROOM Software

Students who use *Newsroom* to create newsletters find good reasons for writing and interesting content to write about. The program also gives them the capability to produce high-quality printed copy. Students can compose, edit, and revise information on the screen, then use the page design function to incorporate text and graphics.

Newsroom integrates several different computer functions not normally found together: telecommunications, graphics, word processing, and page composition all on one disk. The recent boom in desktop publishing systems with laser printers represents a tremendous improvement in print quality over *Newsroom*, but the cost of those systems make them impractical for most school-based programs.

Newsroom is a high quality software program that can be used by teachers in a broad range of content areas. It meets basic software criteria, and offers certain advantages:

- It is cross-categorical, for use in various subject areas.
- It can be used with a range of age and grade levels.
- It is relatively easy to learn and use.
- It is available at reasonable cost.
- It is developed for, and can communicate between, various kinds of Apple, IBM, and Commodore computers.
- It is technically sound, crash-free, and logical to use.
- It allows users to modify, change, edit, and reorganize material (graphics or text) at any time.
- It is flexible; additional graphics and peripherals can be added to enhance the finished product.

Characteristics and Features of NEWSROOM

The *Newsroom* software package is made up of six basic systems:

1. The Copy Desk—Word Processing

While it is not the most sophisticated word processor, especially for those who have used other word processing software, *Newsroom* lets users compose text, then format it to accommodate graphics that can be added later. The screen shows accurately how the final page will appear. The program offers a choice of five type fonts (three large, two small) and numerous "clip art" images.

Depending on the paper size and the type of newsletter being produced, each page can hold from six to ten panels of written copy.

"Panel" is an arbitrary term, meaning a block of text with or without graphics; a single article might use from one to 10 panels. Panels can be saved on a separate disk and recalled during the layout phase.

2. The Photo Lab—Graphics

The Photo Lab simulates the process newspapers follow in modifying photographs for publication. Images can be selected from clip art disks, modified or left as is, and stored for later inclusion in articles. The art can be used quite small or can occupy full panels on the final page.

After the pictures have been selected and "developed," they can be stored on the data disk to be added to articles or changed at a later time. The photo lab also includes a large selection of graphic tools for drawing and shading clip art images. Text can be integrated with the art before the picture is "developed."

3. The Banner—Headlines and Flyers

Banner capabilities allow students to compose headlines for newsletters and flyers. Text and graphics may be integrated into the chosen banner design. The same graphics tools used in the photo lab are also available for banners, allowing the writer to modify the images or create entirely new elements. High-resolution images from Apple DOS 3.3 disks can also be modified in the photo lab and incorporated into banners.

4. Layout—Composition and Pasteup

Four basic page layouts are available with *Newsroom*, using 8-½ × 11" or 8-½ × 14" paper, with or without a banner headline. The smaller paper can accommodate six panels with a banner or eight panels without a banner; the larger paper allows eight or ten panels to the page. Art, text, and banners that have been composed, titled, and stored on the disk can be printed in specific locations on the final page. Page layouts can be saved on disk, then called up later to be printed or reorganized.

5. The Wire Service—Telecommunications

No need to mail disks: *Newsroom* software uses a modem to send data through telephone lines. Two or more *Newsroom* users, even using different computer brands (Apple, IBM, or IBM-compatible),

can send individual panels or entire newsletters over the phone. Users in different locations can share information, or one editor at a central computer can coordinate material sent in by far-flung writers.

As long as the sender and the receiver transmit their information at a common speed, the software is designed to conduct the exchange accurately. *Newsroom* works with all major brands of modems, and will accommodate speeds of 300 or 1200 baud ("300 baud" is roughly equivalent to sending 300 characters per second). Users will want to test their connections before sending important information, but it is possible to send a one-page file from one computer to another at 300 baud (the slowest commonly available speed) in 15 to 25 minutes.

6. The Pressroom: Printing Options

Newsroom accommodates most of the typical hardware configurations used to print information from disks. Once the hardware set-up has been selected and entered on the disk, it does not need to be changed unless that disk is used on different equipment (e.g., same computer with a different printer).

A student who has completed a page layout, with specific panels assigned to designated positions, can use the Pressroom's printer function to produce a clear paper copy. There is also an option to print only the banner, single panels, or photos for editing purposes.

NEWSROOM Limitations

The word processing system used for the copy desk of *Newsroom* is unusual in that it accommodates both graphics and type; but it is tedious to edit, slow to operate, and rather clumsy to use. It is an easily-understood program for first-time users, but people familiar with well-designed word processing software may find it frustrating and limiting—not the flexible writing experience that word processing should be. Most people need an hour or two to get the "feel" of the program before they can compose smoothly at the keyboard. Some students may require extra training time and experience before they can use the program effectively.

Newsroom offers a limited number of type styles and sizes, and of layout options. It is a safe, easy, and secure way for beginners to produce a newsletter, but more experienced users—especially those who want sophisticated copy, may find its limitations frustrating.

Variations on the NEWSROOM Theme

Until recently, *Newsroom* software could only use the graphic images provided on its own clip art disks. The recent introduction of version 1.97 and 2.0, and the "convert picture" option allow use of graphics from many sources.

Computereyes is a video digitizer, an inexpensive way for users of Apple II computers to increase their graphics capability. (For a comprehensive discussion of video digitizers and their inner workings, see "Eyes for Your Apple" by Anthony Reveaux, in the March 1986 issue of AkA‹.) Using a standard video camera, users can choose three levels of digitization, with scan rates ranging from four to 45 seconds. These modes depend upon the available light as well as the patience of the subject.

The *Computereyes* module is a small black box that is connected to the game or joystick socket of Apple II series computers. It is compatible with both Apple DOS 3.3 and ProDOS, and plugs into the video source with an RCA-style phono-jack. The software that comes with the package will save captured images on a standard data disk. Captured images can then be used with the "convert picture" option from the *Newsroom* Photo Lab, allowing students to use real photographs in their newsletters and other projects.

Art and Graphics Modification

Although more than 2000 clip art graphics are available for use with *Newsroom* (three disks from Springboard), the ability to select graphics from other sources is an option in versions 1.97 and later. Students can use standard 34-sector, Apple DOS 3.3 high-resolution pictures to obtain art for a newsletter, making graphics potential practically limitless.

The graphics tools available with *Newsroom* permit users to create original images, but far more flexible options can be found in commercial graphics production software packages. The *Newsroom* "convert picture" will adapt pictures from *Blazing Paddles*, *Micro-Illustrator*, *Flying Colors*, *Rainbow Painter*, and any other system that saves graphics as normal 34-sector binary files. *MousePaint* and other ProDOS systems can convert graphics to DOS 3.3 format, using the System Utilities disk (version 2.1 or later). A new software package developed by the Big Red Apple Club of Nebraska will also convert *Print Shop* graphics for use with *Newsroom*.

One note of caution for those considering the conversion and modi-

fication of outside graphics: while it is fairly easy to convert a variety of graphic images to *Newsroom* format, it is far less time consuming to use the clip art already available from Springboard.

Telecommunications and Connections

Newsroom "Wire Service" options permit easy transmission of text or newsletter to other *Newsroom* users across the room or in another building, district, or country. Once the software disk is configured to work with the particular modem, the rest of the operation is automatic. *Newsroom* instructs the receiving computer to await call, "and the sending computer automatically dials the receiving computer. Then the connection is established, the sender begins transferring file information. The program notifies sender and receiver when the transmission is complete. The software can transfer only one page at a time, which means that separate calls must be made for each page of larger newsletters. Little or no telecommunications experience is necessary—the "Wire service is very friendly.

Recommendations

Newsroom is a positive example of high quality software for publishers who wish to target the educational market. It is useful for various subject areas and a wide range of student ages and grade levels. It is an uncomplicated version of integrated software, offering multiple functions that allow students to complete several tasks on one system. It is easy to use, relatively inexpensive, and available for the computer brands most commonly found in schools.

Both students and teachers require training and experimentation to achieve fluency with *Newsroom* capabilities. The more knowledge students have about how computers handle information and graphics, and about how real newspapers are published, the more easily they will learn to use the program. Previous computer experience, though not necessary, is certainly helpful for students using any software— including *Newsroom*.

Finally, the introduction of peripheral input devices and the capability to manipulate and modify graphics strengthen and enhance an already interesting product. Compatible with the new and challenging responsibilities being accepted by today's schools, *Newsroom* is a prime example of "tool software." This type of product flexibility and versatility is recommended to software buyers looking for packages that will enhance their instructional programs as well as to the software publishers who design and market them.

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LEARNING WITH LOGO: A SUCCESSFUL EXPERIENCE

By Gerald Pollard

In 1982, the Texas School for the Deaf offered its first computer literacy class. Designed for talented and gifted secondary students, the class focused on computer problem solving skills. Encouraged by the success of that class, in 1984 the school sought to provide positive computer experiences for students with lower than average academic skills. That was the beginning of our LOGO classes.

For several semesters, I have found that teaching LOGO to learning delayed students can be a successful, rewarding experience. Students with limited skills and no prior experience of computer programming quickly mastered LOGO and enjoyed working with it. Many of our students were able to advance to the regular computer literacy class, well prepared by their LOGO experience.

Classroom Expectations

As in any classroom situation, a set of basic rules enables students to work together smoothly. LOGO students are expected to:

- Come to class on time, get out workbooks and disks, and boot up the system.
- Complete their assigned work first, then work on their own projects.
- Ask questions when they are unsure of something.
- Work for mastery, taking as much time as necessary.
- Pay attention and participate in class discussions.

The first day of class, students learn how to care for the hardware and software they will be using. They learn how to boot up a LOGO system, and how to move the turtle around the screen to make different shapes. They learn directional commands: forward (FD) and back (BK); the angle or degree commands: right (RT) and left (LT);

and the distance commands or turtle steps (FD 50). They also work with such other commands as penup (PU), pendown (PD), and penerase (PE).

Lectures are brief and specific, because it is clear that students learn best through hands-on computer practice. Concepts introduced through lectures or reading can be explored, expanded, reinforced, and reapplied through computer experimentation. Students enjoy finding answers to their own questions: Will it work if I move to the left? What will happen if I increase this number? How would colors look? How can I add this procedure to the last thing I did? It is exciting to watch students discover and share new computer functions.

Computers lend themselves perfectly to self-paced learning. Every student has a workbook that presents a series of programming concepts, lists their rules, and offers practice examples of graduated difficulty. It also has sections on debugging and problem solving. Students work at their own speed. As they go along, they record computer output, answers to questions, programming statements, and other important information in their workbooks.

The teacher serves best as a facilitator, helping students who are stuck, praising those who make good progress, and challenging those who need more difficult assignments. If possible, students should be encouraged to solve their own problems. When it seems helpful, the teacher can cite similar problems and their solutions, or ask students to go over the rules again to be sure they understand.

What Does LOGO Do?

Of the many benefits LOGO offers students, one of the most valuable is its ability to teach fundamental computer concepts in an enjoyable format. The game-like format of LOGO helps our students master a wide variety of computer programming concepts while creating graphics on their screens.

Most LOGO functions are similar to those of more advanced programming languages. For instance, at the beginning of the semester, students explore three ways to communicate with the computer in LOGO through immediate, teach, and edit modes. They learn that without program line statements, communication is in the immediate mode. Program line numbers put them into a teach mode, and a line editor lets them edit text one line at a time. BASIC programming uses a similar series of functions.

The repeat and recursive function objectives of LOGO illustrate the concept of loops—repeating a procedure many times. The same concept is expressed in BASIC. LOGO's top-down programming objectives teach students to break large problems into smaller segments. Students can program for these smaller parts, then combine the subprocedures with a final superprocedure. The same methods are utilized in BASIC, PASCAL, and other programming languages.

During our course, we teach students how to use variables, changing the size of a shape by changing its value. The same concepts are expressed in BASIC with LET statements (LET A = 5). Changing the value of a variable is fundamental to all computer programming.

Logo Course—One Semester

The sequential objectives set up for the LOGO class have been used and revised as needed to provide computer skills in meaningful sequence. They are presented here as one example of a practical course in LOGO computer programming for learning delayed students.

Sequential Objectives

Objective A: Teach proper care of computer software and hardware. Students will learn:

1. The components of a computer—monitor, keyboard, disk drive, CPU.
2. The proper way to insert a disk and boot up a system.
3. How to boot LOGO.
4. Keyboarding skills and the special function keys.

Objective B: Teach students how to create pictures on the screen using LOGO specific commands. Students will demonstrate proper use of the following:

1. Directional commands, as forward and backward.
2. Angle or degree commands such as right and left.
3. Distance (turtle steps) commands such as forward 50 or right 90.
4. Penup, pendown, and penerase commands.
5. Screen commands such as show turtle, hide turtle, clear screen.
6. Color statements such as SETPC 3 and SETPC 5.
7. Circle and arc commands.
8. Additional screen commands such as full screen, split-screen and textscreen
9. Creation of a screen graphic that matches a pattern on paper.

Objective C: Teach three modes of communicating with the computer. Students will be able to:

1. Identify the IMMEDIATE mode by the ? cursor.
2. Type appropriate commands for the desired turtle response.
3. Discuss advantages and disadvantages of the IMMEDIATE mode.
4. Recognize the TEACH mode by its ">" cursor.
5. Demonstrate how and where to use the END command.
6. Type in and run a program in the TEACH mode.
7. Get into LOGO's EDIT mode.
8. Use the following EDIT commands appropriately:

CTRL F	CTRL N
CTRL G	CTRL C
CTRL A	CTRL E
CTRL P	CTRL O

9. Demonstrate two ways to exit the EDIT mode.
10. Discuss advantages and disadvantages of the EDIT mode.
11. Demonstrate the proper way to save and load a file, catalog a disk, print out titles (POTS) and print out procedures (POPS).
12. Demonstrate the proper way to erase files from memory ER <FILENAME>, ER [FILE1 FILE2 FILE3]), and from the disk (ERASEFILE <FILENAME>).

Objective D: Teach the proper use of repeat and recursive function commands. Students will:

1. Use the REPEAT command properly with a circle and arc statements.
2. Use the REPEAT command to make geometric figures such as a square, triangle, pentagon, hexagon, and octagon.

Objective E: Teach top-down programming procedures for designing and programming LOGO graphics using several subprocedures and one superprocedure. Students will be able to:

1. Draw a graphic on paper, then identify smaller portions of the graphic.
2. Create a subprocedure program to draw each small segment of the larger graphic.
3. Combine several subprocedures with one superprocedure.
4. Describe a subprocedure and a superprocedure.

Objective F: Teach the proper use of one, two, and three variables within a program: Students will be able to:

1. Explain the difference between a value and its variable.

2. Demonstrate how to make a shape and change its size by using the SIZE variable.
3. Demonstrate the proper use of SIZE and ANGLE variables.
4. Demonstrate the proper use of SIZE, ANGLE, and INCREMENT variables.

Objective G: Teach the use of the conditional IF statement for making polygons and spirals.

1. Students will demonstrate proper use of a conditional statement such as IF :SIZE > 75 STOP].

Objective H: Help students integrate various computer skills to create a final graphic for demonstration at a computer fair. Students will:

1. Create their own graphics on paper.
2. Write a series of programs to draw portions of the specified graphic.
3. Combine several subprocedures with one superprocedure.
4. Explain and demonstrate their graphic programs to other students.

Teachers at the Texas School are pleased to note that the LOGO class offers our students far more than a chance to learn computer programming. It also helps foster confidence and self esteem for students who have had few previous chances for success in academic life.

COMPUTERS AND THE WRITING PROCESS

Robert D. Storm

In May 1985, the Clarke School for the Deaf received an Apple Educational Grant in conjunction with Smith College. The purpose of the project was to explore the use of microcomputers to improve the written language competence of hearing-impaired students. The grant provided enough microcomputer systems to allow a "programmatic immersion" of selected students at the school.

A 1985 Johns Hopkins University national computer survey found that in order to use computers profitably on a regular basis, students should have access to the computers for a minimum of two to three hours every week. Because of the Apple grant, the 60 students regularly involved in Clarke's language/computer research program are able to use computers on an average of three to four hours per week, with primary emphasis on word processing. The advantages of this high level of computer use include improved typing speed and accuracy, regular reinforcement of word processing skills, and increased flexibility and sophistication of writing.

Computer Background

Before 1982, few students or staff members at Clarke School had appreciable levels of computer experience. A group of teachers representing the three major academic divisions of the school was appointed to develop a proposal for implementing the use of computers into the Clarke program. The group designed a three-year plan that covered budgetary needs, space requirements, type and quantity of hardware, and a software evaluation/purchasing procedure.

Computer literacy was targeted as the initial area of emphasis. By the fall of 1982, several microcomputers had been purchased and computer literacy classes began. By September 1984, enough computers were available to accommodate each student in a class of eight. In the fall of 1985, because of the Apple grant, Clarke School

had enough computers—for students and staff—to make "computer immersion" a reality.

Exploring the Writing Process

Severely reduced language competence is the fundamental problem created by prelingual deafness. One aim of the Clarke School-Smith College language/computer research project was to develop instructional strategies utilizing word processing, and then to incorporate those strategies into the language-based curricula. We established a set of procedures for developing written language skills, and continue to refine them as they are used in the project.

Writing is a very complex process. Writers pass through numerous developmental stages, at individual rates and at varying levels of skill. For example, children learn to put together groups of written symbols to form meaningful words. In time, they learn to combine those words into phrases and sentences, following certain rules of grammar and syntax. Phrases and sentences are eventually arranged in specific order and then blocked off into paragraphs, and so on.

Each time students engage in the writing process, they are embarking on a new adventure. Some adventures—like doing independent research—are like travel into the unknown. Others—like writing to a good friend—resemble a walk down a familiar street. How do students learn to write and to improve their written communication? The old adage that "the best way to learn is by doing" seems quite appropriate here: people learn to write by writing.

Most students need reasons to write: "I want to write a letter to my pen pal." "My teacher wants me to write a composition." "If I write a research report, then I'll get extra credit." The reason often determines the type and quality of the final product. The more compelling the reason for writing, the more likely that the end result will be of good quality.

The act of writing usually supposes a reader or readers—a reading audience. Sometimes an audience can be a very strong motivator: "I haven't written to my parents in several weeks." Other audiences can serve to inhibit writing: "Every Monday my teacher makes me write five sentences about my weekend and then marks it all up and gives it back to me to correct!" All too often, teachers may unwittingly reinforce negative student attitudes about writing, and those attitudes may become entrenched.

In theory, the more frequently students use word processing technology, the greater likelihood that the quality and quantity of their writing will increase. (Indeed, the same results might be expected of teachers!) The reasons for this supposition seem obvious. Revisions and editing become relatively easy, especially when using a sophisticated word processing program like *AppleWorks*. This capability upgrades the quality of the final project. Also, most word processing programs are flexible enough to allow quick changes in document format. It is generally easy to learn to use most word processing systems, and repeated use helps students become familiar with a program's special features. In other words, using a word processor can be "powerful fun."

Project A. Putting Theory into Practice

More than 60 Clarke School students, ages nine to 19, are currently working to improve their writing skills, using the power and flexibility of the AppleWorks word processing system. An open-ended sequence of writing stages guides the students' work.

- First Stage—Creating: Students use AppleWorks to create written material on the computer.
- Second Stage—Self-Editing: Students edit first drafts.
- Third Stage—Refining: Students and instructor discuss and further edit the written material.

Creating:

Samples of all the students' written work are collected regularly, including numerous examples of written material as it goes through these three stages of writing. (See Appendix A for samples.) At the "creative" level, whenever possible and practical, students should help choose the topics they will write about. The more material students generate at each stage of the process, the greater their personal investment in the writing. That commitment is likely to persist during the refining stage, increasing their comfort with writing and their willingness to write more frequently.

Our experience at Clarke demonstrates that the use of word processing technology significantly enhances students' willingness to write. Their enthusiasm tends to affect not only their work in the language arts curriculum, but also generalizes to other subject areas.

One of the many fringe benefits of having students use word processing is that many will produce writing, punctuation, and spelling

2nd Draft
9/25/86

Myself

My name is (___). I am a hearing impaired girl. I am seventeen years old. I am five feet and three inches tall. My hair is dirty blonde and my eyes are hazel. I am a preppy, and I like classic ~~and a little~~ fashion, ~~clothes.~~ I have one sister and one brother. They are older than I am. I am the baby in my family. My sister who is 25 years old works in Boston and she is a ~~businesswoman~~ business woman. My brother is 24 years old and he works in Springfield. Both have graduated from college.

I live in Worcester, Mass. and I have lived there all my life but I go to boarding school in Northampton. The name of the school is Clarke School for the Deaf. It is an oral school and it is the best ~~(to learn)~~ because I for me to use speech a lot. I was at Clarke for six years. This is my last year of school and I am a senior in Upper School. Next fall, maybe I will go to Worcester Academy or a different high school.

My favorite hobbies are reading ~~the~~ books, listening ~~to the~~ music, and doing art~~ing~~. I love to dance and it is really fun with boys, ~~and listening the music.~~ or by myself. My favorites sports are swimming, skiing, and tennis and my best sport is windsurfing. I play on the basketball team at my school and I am not a very good player. It is fun to play and I ~~was~~ have played on the basketball team for two years. This year, I am thinking about ~~to~~ being a cheerleader or a basketball player.

Following a teacher conference, this student edited her own first draft.

that is clearly legible for the first time. This helps eliminate the kinds of fudging made possible by intentional scribbling. For example, appropriate verb endings are more easily discernible on a computer printout than in illegible handwriting, as are tricky spelling combinations and the placement of apostrophes.

Self-Editing:
This is a complicated operation, with the major goal of helping students participate more actively in the editing process. They review their first drafts without teacher intervention and make whatever changes they think will improve the quality of the composition. Students are encouraged to print the first draft double-spaced and edit directly on the printout.

Many students at Clarke saw the emphasis on editing their own work as a very real shift in responsibility. They had considered editing the exclusive domain of teachers, but quickly came to appreciate the fact that they could also exercise this kind of control over their work. After several months, the self-editing stage became a routine and accepted part of the procedure for both students and faculty. Of course it was a much more difficult task to assist students in editing their work effectively.

It became obvious early in the program that the students needed more editing practice. To provide that practice, a group of teachers is now systematically developing paragraphs that contain typical student errors. The paragraphs are controlled for type of error: i.e., one paragraph will contain only errors in subject-verb agreement; a second, similar paragraph might also include verb tense errors. Students also may be given clues to the types of errors they are trying to find.

Later, students are asked to edit paragraphs that contain a variety of mistakes, without specific information about the types of errors present. Subsequently, the students' work is analyzed to determine whether progress in self-editing carries over into their general writing.

Refining:
Any number of modifications and revisions of the original written material can occur during the refining stage. Ideally, the process of student/teacher discussion should continue until both are satisfied with the final product. A few general editing strategies have helped facilitate this process.

- Throughout the writing process, the teacher's encouragement and genuine interest are essential. The teacher should read the

THE APPLE OF OUR EYES

Vol. 2

Edition 1, Oct.'86

On Halloween Night

Written By Laurel Maradik

Once there was a girl who was lying in her bed at midnight. She couldn't sleep, so she decided to go for a walk. She went outside and walked down the sidewalk. She was having a good time enjoying walking by herself. Then she heard some STRANGE footsteps behind her. She kept walking and she tried to ignore the sounds of the footsteps. Consequently, she heard some STRANGE footsteps coming toward her. She walked a little faster and she could still hear the footsteps which made her scared and worried. She tried to walk as fast as she could, but she still could hear the footsteps approaching her. Suddenly, she heard a WEIRD voice say, "Little girl, I'm only your father!"
She said, "No! You are not my father!" So she ran away as fast as she could.

She ran into an OLD graveyard which looked spooky! She found an ancient house in the graveyard. She went in and locked the door. She heard someone pounding at the door very loudly. She was so frightened, she didn't know what to do. She saw a rusty gasoline can in a small closet. She took the gasoline along with her. She opened the door quickly and let someone in. She splashed the gasoline all over the person. Then she ignited it. The person burst into flames.

Then she ran wildly back home. She saw her mother was out at the steps. The girl tried to be cool and pretend that she didn't know what was going on. Her mother asked the girl, " Where have you been?"
"Oh, I was just taking a walk by myself," said the girl. "Have you seen you father?," she asked. "No," the girl answered. Her mother said, "Well, your father has been looking for you!"

The President of Student Council

On Oct. 8 there was a student council rally day. There were 4 candidates who gave speeches. They were Chris Duffy, Eric Osgood, Tahir Rathore and Branton Stewart.

It was fun at the rally day program. It also was very noisy! Some of the kids screamed and yelled and some of the kids were shouting, "VOTE FOR CHRIS. VOTE FOR BRANTON. VOTE FOR TAHIR. VOTE FOR ERIC." Also some of the girls wore green clothes for the Irish girl-Chris Duffy.

On Oct. 9 was election day. At first, the score was tied between Branton Stewart and Chris Duffy. So we had to have a run-off election. The score was really close. Chris Duffy won the election by only 2 votes!

Here are some questions about how the students felt about her becoming president of student council.

Chris Markovic- He thinks she will be a good president, because she explained a lot about the students' problems. Also she told him to put his hands down instead of using sign language. He's very glad that she's the president of student council.

Victor Battani- He is happy that she won the student council presidency. He thinks she will work hard and she has a lot of experience at Clarke School. He wishes Chris Duffy good luck!

Patty Garcia- She feels really happy that Chris became president of student council, because Chris always is polite. Chris Duffy also always helps her and the other deaf students to solve their problems.

Written by
Laurel Maradik

Newsletter staff people are very enthusiastic about their work.

student's work, offer honest, positive comments, and set an upbeat tone for each discussion.

- The student and teacher should discuss the overall organization of the composition. If the writing needs to be reworked at this phase, the student should be given an opportunity to make changes.

- The student should read the composition aloud. Students often find grammatical and syntactical errors while reading aloud that they might otherwise overlook without teacher prompting. Sometimes the blackboard or a separate sheet of paper can be used to check spelling and test other modifications, without writing on the student's paper. It is important to make sure the student understands the concepts being discussed.

- At the end of the discussion, the student makes the needed improvements or modifications. The changes are made on the paper, usually in pencil, then typed into the original document and saved on the disk. After printing out this second draft, the student should read it aloud again and discuss additional changes.

Teacher/student writing conferences, depending on the age and abilities of the student, may cover anything from a few sentences to a one-or two-page composition. Teachers should try to avoid using such words as "wrong, mistake, error" during the conferences. Terms like "improving, changing, and revising" have a more positive connotation, and should be used frequently.

Throughout the entire writing process the teacher's encouragement and genuine interest are essential. Good rapport and mutual respect are equally necessary. When students become "owners" of these editing skills, they will be able to recognize the need for modifications and act on them.

Project B. "The Apple of Our Eyes"

As a practical application of their new writing and word processing skills, students at the Clarke School began in the fall of 1985 to publish a desktop school newsletter, *The Apple of Our Eyes*. The publication team uses *Newsroom* software, a two-disk system developed by Springboard that sells for approximately $60. *Newsroom* is advertised as the most popular and widely used newsletter-format

software package on the market. Available for Apple, Commodore, and IBM computers, the program is recommended for use by students in seventh grade and above.

Newsroom consists of a master program disk and a two-sided clip art disk. To use the program effectively, students need additional blank disks for information storage. It features:

- Several different styles of type.
- A library of 600 graphics that can be combined with text.
- Capacity to create original graphics.
- Capability to design newspaper banners.
- Page layout options.
- Capability to transfer information via modem.
- Formatting for newspaper columns and pages.

Small groups of both middle and upper school students at Clarke have worked on the development *of The Apple of Our Eyes*. Currently, a group of eight upper school students and one faculty advisor are responsible for the overall production, design, and publication of the newsletter. Club members are very enthusiastic about their work. They write a wide variety of stories covering everything from school news and writing contests to international events. They interview staff members and visitors, and take opinion polls. (See Appendix B, the October 1986 issue of *The Apple of Our Eyes.)*

School newspapers are not new at Clarke. Before the use of microcomputers, however, publication of the newsletter was more time consuming, requiring the assistance of several secretaries. The many options available on the *Newsroom* software make the tasks of planning layout, creating columns, and inserting photographs much easier and more enjoyable.

The newsletter was created as another way to help students develop their writing skills. Club members are strongly motivated to be as specific and accurate as possible, because they identify strongly with their final product—the newspaper. They take a great deal of pride in the fact that their paper is circulated to more than 200 individuals and schools.

Some newspaper-related terms have become a functional part of the students' oral and written language. Working on the newsletter requires students to organize their work, and helps them improve their vocabularies along with their writing skills, because each issue includes such a wide variety of articles. In a recent issue, for

example, one student reported on the Boston Red Sox while another wrote movie reviews.

NEWSROOM: Useful but Not Perfect

The *Newsroom* software program does have significant weaknesses. The documentation is poorly written and often confusing. It does not emphasize crucial information, often leaving users to solve their own problems through trial and error. The program also has limited word processing capabilities; for instance, it does not have a "move text" function. The printout command is slow, and it lacks the capability to print double or triple space, an essential feature for editing.

The option of adding pictures to text is attractive, but the operation is quite time-consuming. *Newsroom* also requires an excessive amount of "disk switching," since there is only one master program disk. Club members frequently have to compete for the master program or clip-art disks.

Despite those drawbacks, Clarke students enjoy using the Newsroom software. The most relevant fact is that it allows them to produce a periodical with wide readership. That is compelling motivation to meet deadlines, and to write clearly and well.

Project C. Telecommunication with Microcomputers

Dr. Doris Naiman of the Division of Education, Department of Communication Arts and Sciences, New York University, is currently conducting a research study titled "Telecommunications and an Interactive Process to Literacy in Young Deaf Adults." Clarke School students have been part of this project since 1983, when Dr. Naiman began preliminary field testing of telecommunication devices. General Telephone and Electronics company (GTE) is providing the equipment and use of their telecommunications network for this research program.

Twelve upper school Clarke students and two teachers are currently involved in the telecommunications project. Each student is provided with an individual mailbox on the GTE network, and has access to several computer bulletin boards.

The students use their computers to exchange messages with "telecommunication pals" at other schools, and to create materials for the computer bulletin boards. Every Clarke student involved in the

project is also part of a "Delayed Interactive Language Remediation Approach" developed at the Clarke school. This approach was designed to help the students engage more effectively and efficiently in written dialogue.

This is the way the system works: the student writes a message on the computer, prints it out and does preliminary editing on the paper copy. Then the teacher and the student discuss the edited draft. The AppleWorks word processor and Apple II Access software, which are compatible with the GTE telecommunications network, allow students to create and save written material, as well as to retrieve messages in only a few seconds. This considerably reduces the amount of telephone time needed for sending messages, and is directly reflected in monetary savings. (See the telecommunication sample, Appendix C.)

This research study is still in progress, and the findings are preliminary. Teachers of participating students, recently asked to evaluate their students' writing and reading skills, attitudes, and self-confidence, reported that many students improved their writing skills more than expected. Students involved in the study demonstrate motivation to read and write more frequently and with greater care.

A Helpful Conclusion

Three major programs are outlined in this article: an Appleworks writing project, a school newsletter, and a telecommunications system. All of the projects involve students in writing and editing on the computer, and require ongoing support from concerned teachers. Each of the projects is perceived as helpful in improving students' writing skills. Through a carefully designed computer-based writing program that includes regular teacher/student interaction, the involved students are highly motivated both to read and write frequently and with increased care.

"RIGHT!" "RIGHT!" Learning English as a Third Language By Computer

Lee Cooper and Monique Loubert

"Can Johnny—or Jenny—read . . . and write?" This perennial question for the population at large takes on heightened significance for educators of deaf children. Studies show that most deaf students have poor comprehension and use of English. Investigating the language skills of deaf children, Anne Geers and her colleagues at the Central Institute for the Deaf in St. Louis found overwhelming evidence that few of the profoundly deaf children in their research project were learning English effectively, regardless of their communication modes.

In Canada, there are no comparative studies of the French language competence of the relatively small deaf population in francophone Quebec. The testimony of teachers and speech therapists, however, would point to similar conclusions. The great majority of deaf secondary students in Quebec are unable to continue with post-secondary education, because they cannot adequately read and write French.

Hearing Impaired But Multilingual

In the Quebec City area, deaf secondary school students who follow a total communication (TC) approach are partially mainstreamed, studying some subjects in separate classes with teachers of the deaf, others in regular classes with interpreters. All these classes for deaf students using TC methods are housed in the same secondary school in the suburb of Charlesbourg. The language used by most classroom teachers of deaf students is pidgin signed French. Among themselves, deaf students usually use "la langue des signes quebecois" (LSQ) a language whose origins resemble those of American Sign Language (ASL), but which has kept even closer ties to French.

English is taught as a second language throughout the school system: for regular students, English instruction starts in the primary grades. For hearing impaired students, who begin studying English in the 7th grade, it is essentially a third language. For many deaf students, their inadequacies in French spill over to inhibit learning of English. The problem is compounded because there is little use of English in the Quebec City region (the exception being English TV and rock videos). Without linguistic exposure, it is hard to motivate any child for the difficult task of learning another language.

Searching for ways to use Computer Aided Instruction (CAI) with deaf students, we discovered an English grammar program, MICRO-LADS (Microcomputer Language Assessment and Development System). Produced by Laureate Learning Systems in nearby Burlington, VT, this program provides tutorial training and testing for a broad range of grammar constructions. It was developed by Mary Wilson and Bernard Fox, based on years of experience as speech therapists and researchers, and on their pioneering work with computerized remedial language programs.

The program is based on generative grammar linguistic theory and research in psycholinguistics and instructional techniques. It uses color graphics, interesting animation, spoken and written text to build syntactic comprehension. Table 1 outlines the seven-diskette tutorials for training and testing.

Table 1. Grammatical Constructions Covered in MICRO-LADS:

Disk #1: *Noun Plurals/Noun-Verb Agreement*

third person singular noun/verb, third person plural noun/verb, singular/plural, has/have

Disk #2: *Verb Forms*

present progressive (V + -ing), simple present, future (modal will), regular past (-ed)

Disk #3: *Prepositions*

in, on, under, behind, next to, in front of

Disk #4: *Pronouns*

subjective	objective	possessive
he	him	his
she	her	hers
they	them	their

Disk #5	*Negatives*	
	negative determiner "no" (has no)	
	negative transformation (is not)	
	negative transformation (are not)	
	negative transformation (does not)	
Disk #6	*Wh- Questions: Who/What*	
	passive: present passive	
	deictic expressions: here/there, this/that, these/those	
Disk #7	*Prepositions II*	
	between, in front of, above, on, behind, beside, below	

The MICRO-LADS program requires an Apple II computer with a single disk drive. To take advantage of the program's optional oral introductions and comments, a Street Electronics speech synthesizer card is added. Probably most deaf students would have difficulty profiting from this option, so the card might be added as funds become available.

As we were investigating the MICRO-LADS program, teachers of the deaf at the Polyvalente de Charlesbourg (a secondary school with a TC program) reported difficulty with their English language classes. They were using a combination of oral and signed French to communicate the English lessons, and knew that this was not an effective second-language learning situation. The average student attention span was short, and most English examination scores fell below 50 percent.

Since the Polyvalente school had a computer laboratory of Apple IIe's with some free time available each week, we suggested that the teachers incorporate the MICRO-LADS English program into their regular English lessons. The teachers and school authorities accepted our proposal. With financial help from the Quebec Ministry of Education, the Deaf Foundation of Quebec, and the Club Kinsmen, the experiment—teaching English as a third language to francophone secondary students—began in the fall of 1985.

Learning Language Rules

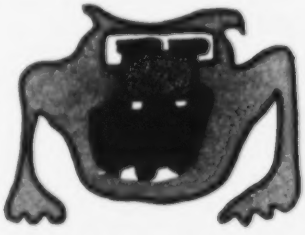
The MICRO-LADS program was not originally developed for teaching deaf children, but for the much larger population of language impaired (LI) students. Based on her training and research as a transformational grammarian, Dr. Mary Wilson developed a lan-

guage intervention program for English syntax, using receptive and expressive intervention approaches, that was published as the *Wilson Expanded Syntax Program* .

It consists of 999 picture cards depicting various syntactic functions within sentence formats. It is based on research into normal processes of language acquisition and on the innate human mechanism for language postulated by Chomsky. This mechanism was named the Language Acquisition Device (LAD) by McNeill in a classic argument for Chomsky's position. Including this acronym in the title of the Micro-LADS program indicates the authors' belief in the unique potential of the human brain, regardless of handicapping conditions.

Rule knowledge is indispensable to normal language functioning. Typically, a lack of syntax rules tends to characterize the communication of LI children. The Micro-LADS program targets this deficit, using extensive vocabulary to introduce a series of basic grammatical constructions in sentence formats. Colorful graphics illustrate the constructions.

Some of the featured constructions (e.g., the prepositions "in" and "on" and the noun plurals) normally begin to emerge early in the two- word utterance stage of language acquisition, so that early use of this program can help even very young LI children. As children acquire basic syntactic competence, their vocabularies also tend to grow. Even a totally receptive language program such as Micro-LADS can help build language competence; studies show that both expressive and receptive skills improve with comprehension training.



Left: The bouncy green blob introduces other characters.
Right: Monster Blob reinforces accurate work.

The Micro-LADS program incorporates errorless learning principles based on behavioral analysis research, using cuing, small steps, and generous reinforcement to facilitate the learning process. Tak-

ing a cue from the creators of video games, who specialize in eliminating boredom, Wilson and Fox designed unique animated characters to provide reinforcement and entertainment for each diskette. The bouncy green BLOB introduces the other new characters on each diskette, while MONSTER BLOB, with his raucous verbal "Right! Right!" reinforces the work of students with residual hearing.

Our francophone deaf secondary school students were, of course, beyond the two-word utterance stage even in English, but they were very weak in basic English grammar constructions. We knew from our reading about CAI projects that students overwhelmingly prefer working with computers to interacting with teacher/testers. That hypothesis was confirmed by Wilson and Fox in clinical trials of their software programs. The repetitive procedures built into the MICRO-LADS program, although often denigrated by educational experts, are seen as very effective for language intervention, particularly in second-language learning. The computer is uniquely suited to these types of exercises.

Wilson and Fox incorporated two proven instructional feedback techniques into the MICRO-LADS program: Knowledge of Correct Response (KCR) and Cuing of Correct Response (CCR). With KCR, correct answers are reinforced. Learners are rewarded for correct responses by an animated routine. When the student makes an error, the Micro-LADS program provides a visual cue and a second prompt. If the student makes a second error, the program emphasizes the correct response and provides added instructional feedback.

We were convinced that this combination of pedagogically sound educational techniques and animated color graphic reinforcement routines would help students maintain their interest in following the lessons. We also judged that the continuous graphic presentations of English on the screen would give our students the closest approximation to a "linguistic bath" possible in our classroom.

Using MICRO-LADS

The title page of each diskette presents a choice of two ways to use MICRO-LADS: Testing , which can be used for before-and-after assessment, and Training , for systematic instruction. For example, loading Diskette #4 for pronouns, and keying in "Training," calls up the Training Constructions Menu (Figure 1). This diskette presents the basic personal pronouns, each of which can be taught

individually or in combination with the other pronouns in the lesson. This flexibility is a feature of all MICRO-LADS programs.

Students who choose the possessive pronoun 'HER' (#10 in Figure 1) will move to the Parameters Menu, Figure 2. This second menu permits the student, instructor, or speech therapist to control the lesson, adapting the speed and requirements of the exercises as needed. Slow learners can be allowed more time to respond (#5, #6), permitted more errors before recycling (#8), or be asked for more correct responses before moving on to more complex forms (#7, #9). Quick learners can move ahead at their own pace. This

Figure 1. MICRO-LADS Training Constructions Menu

```
PRONOUNS:  SUBJECTIVE
             1. HE
             2. SHE
             3. THEY
             4. HE/SHE/THEY

           OBJECTIVE
             5. HIM
             6. HER
             7. THEM
             8. HIM/HER/THEM

           POSSESSIVE
             9. HIS
            10. HERS
            11. THEIR
            12. HIS/HERS/THEIR

           YOUR CHOICE ?
           [esc] TO RETURN TO TITLE PAGE
```

adaptability is the key to using MICRO-LADS with a wide variety of deaf students, including those with additional handicaps.

After the parameters are set for the particular student, tapping #1 runs the possessive pronoun (HER) lesson. Each grammatical construction is taught and tested by sets of two or three pictures. For students with some residual hearing, the lessons can be introduced aurally. The appropriate picture is shown and a verbal introduction is given, with or without written text as the instructor chooses.

"The ball belongs to her. This is her ball."

Figure 2. Parameters Menu

1 TO RUN, 2-9 TO CHANGE PARAMETERS

1. RUN .....(HIS)
2. TEXT IS .....(ON)
3. VOICE IS .....(ON)
4. INTERFACE .....(SCANNING/SS)
5. SCAN SPEED .....(3)
6. RESPONSE TIME .....(5)
7. # CORRECT TO ADVANCE .....(3)
8. # ERRORS TO DROP BACK .....(3)
9. CRITERION TO END LESSON .....(9)

YOUR CHOICE ?

[?] FOR DESCRIPTION OF PARAMETERS
[esc] TO RETURN TO CONSTRUCTION MENU

The students working on the project at the Polyvalente School had little residual hearing, so large-sized text and pictures were always used rather than verbal stimulation. After initial instruction, the screen shows two or three grammatically different situations, with a stimulus sentence underneath. Students choose the appropriate picture by using the space bar, a single switch, the arrow keys, a game controller, or a touch-sensitive screen.

Students read the sentence and choose the appropriate illustration.

The program presents 10 stimulus sets randomly for each lesson, in three increasingly complex levels of instruction. Level I always has a cue triangle over the correct response. Level II has no cue triangle, but the correct picture flashes (CCR) when an error is made. If the student makes a second error, the program provides corrective feedback (KCR). Students who make more errors than the number set in the Parameters Menu are recycled back to Level I.

A counter in the upper right-hand corner keeps score and indicates how many more correct responses are needed to move to the next level. The only instructional technique used on Level III is feedback; this level also requires construction comprehension for correct responses.

When the student completes Level III, two screen menus show the lesson summary. The first page reviews the parameters set for the student and summarizes the student's responses on the three levels of instruction. The second page gives the number of presentations and correct responses for each construction taught in Level III and offers a PRINTOUT option for the summary.

MICRO-LADS for Third Language Learning

Working on this project were 27 severely to profoundly deaf students from the seventh to tenth grades, with their two teachers. We set several basic goals for the project. First, of course, we hoped that use of the Micro-LADS program would improve the students' use of basic English syntax and augment their receptive and expressive English vocabularies. For most of the students, this would also be their introduction to computers. As well as teaching them to manage the program diskettes, we tried to promote self-confidence by letting students select their own parameters for each MICRO-LADS lesson. Only one computer was equipped to print out the lesson summary, so students were encouraged to note their results in writing.

The students were divided into five class-level groups. Each group worked in the lab for one 75-minute period per week. We introduced the teachers to the Apple IIe and to the MICRO-LADS program and tried to give them an idea of how additional CAI programs could be helpful to their classes.

The program was a great success. All of the students promptly learned to manage the computer and the MICRO-LADS program diskettes. They were also quick to comprehend the Parameters

Menu in English, and took the initiative in choosing their own parameters for study and progress.

The most exciting facet of student interaction with the computers was the level of sustained attention they maintained. In regular class sessions, the typical attention span of these students was about 15 minutes; in the computer lab they worked on MICRO-LADS lessons for the full 75 minutes of each period, and maintained this intensity during the entire school year! In our analysis, we theorized that the degree of active participation was due primarily to three factors:

1. *The individuality of the learning experienc*. Each student worked on one computer with lessons tailored to that student's needs and learning rhythm.

2. *The uniqueness of the* MICRO-LADS *program*. With progressive levels of learning complexity and recycling procedures to help correct errors, plus interesting graphics and animation, MICRO-LADS encourages attention and motivates students to continue learning.

3. *The sense of accomplishment* provided by MICRO-LADS. Because this program compiles and displays the results of each lesson, students received continuous feedback on their progress. They did not want to finish lessons without scoring 100 percent, and they often reviewed difficult lessons to improve their scores.

The students' enthusiasm for working with MICRO-LADS proved to us the value of repetitive drilling exercises for LI children trying to master the fundamentals of syntax. We believe, however, that this theory is valid only for drills that can retain student interest. The MICRO-LADS program does a good job of holding student attention with colorful graphics and animation routines.

The real proof of the effectiveness of the MICRO-LADS program in improving the English comprehension of our deaf students lay in their test results. The testing routine built into each lesson was used to measure learning. From November through April, as students completed the training exercises, they took the tests for each section. Thus, over a six-month period, each student took a total of 20 separate tests. During the last six weeks of the 1985-86 school year, we repeated all the tests to assess the students' retention of grammar and vocabulary. Their scores are analyzed in Table 2.

Table 2: MICRO-LADS Results

Comparisons Between First Tests and Retests: Results of 20 Tests

Grade Level:	7th	8-A	8-B	9th	10th	(TOTAL)
Number of Students:	5	4	5	7	6	27
	%	%	%	%	%	AVERAGE
1. Retention: =/+	75	74	60	65	73	69.4
2. Scores of 100 (on Re-test)	45	56	51	43	60	51
3. Scores improved	45	28	32	25	25	31
4. Re-tests below score of 85	12	4	8	11	4	7.8

Line 1 of Table 2 shows that 60 to 75 percent of the retest scores were equal or superior to the students' first test scores. The average retention rate was 69.5 percent. In other words, when the students were retested on the MICRO-LADS lessons, they maintained or improved almost 70 percent of their first testing scores. For students with little exposure to English outside the classroom and the laboratory, these results are significant. Line 2 corroborates the evidence; in 51 percent of the retests, students achieved perfect scores of 100.

Another way to analyze the comparisons of retest scores is to learn whether students were able to improve their testing performances. Line 3 of Table 2 shows that overall 31 percent of the students improved their scores when retested on syntax and vocabulary.

These positive results may be due to the way the MICRO-LADS program approaches the teaching of syntactic materials: students are encouraged to keep working on the lessons until they achieve good scores. Line 4 of Table 2 shows that overall only 7.8 percent of all the retests scores were lower than 85. In view of the fact that most examination scores for these students range from 40 to 70 percent, these results are indeed heartening.

The MICRO-LADS program uses a vocabulary of some 348 English words and verbal conjugations; thus, a group of deaf students with little use of receptively acquired language was still able to retain significant amounts of the presented vocabulary.

One negative comment must be made about MICRO-LADS in its present form. Although theoretically and practically the program is effective in second-language learning situations, it is not currently

available in a language laboratory edition. Each diskette is designed for use in an individual language intervention situation. Given the reputation of educational institutions for pirating programs, it is not surprising that the program incorporates a sophisticated protection system.

During our experimental project, each student was obliged to work on a different diskette during lab sessions. That situation made it very difficult for teachers to integrate the syntax constructions progressively with regular English class sessions. Given growing requests for a laboratory edition, Laureate Learning Systems has indicated that it might reconsider the current policy.

The MICRO-LADS project helped to demystify the use of computers as educational tools for both students and teachers. Both groups also began to see the implications for deaf people of computer technology as a basic communication tool. Much remains to be done to integrate regular use of computers into day-to-day education in our area, but we are more than satisfied with the success our students enjoyed during this learning project. We are also encouraged at the positive responses of teachers to the new technology.

More cooperative planning can help teachers incorporate this and similar programs into curricula for English as a Second Language. Our hope is that, where Apple II computers are available, MICRO-LADS will become a regular feature in beginning English classes. With additional long-range planning and training, as well as good programs in the French language, we may see an overall computer revolution in the education of deaf students in Quebec.

Finally, for the 27 deaf students and the two teachers who participated in this experimental project, it was a stimulating experience. Because of our small market, Quebec and other French language areas have trouble finding French computer programs that are both interesting and useful in educational settings. Thus we are still seeking ways to use CAI materials for regular school subjects.

Our experience with the original English version of MICRO-LADS confirmed our earlier decision to produce a French version for use with young deaf francophone children. We are now convinced that this comprehensive program can also teach basic French syntactic constructions. Just recently we received the funding necessary to complete the project. Perhaps in the near future, deaf students studying French as a third language will be able to watch MONSIEUR BLOB dance on their computer screens, and may even hear him exclaim "Oui! Oui!" as he confirms their progress.

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Computer Program

MICRO-LADS (demo disk $25), available from Laureate Learning Systems, 110 East Spring St., Winkooski, VT 05404; 802/655-4755.

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WHEN COMPUTERS TALK TO VIDEODISCS

By R. Scott Osksa

For the past six years, the California School for the Deaf at Riverside (CSDR) has served as one model for the practical application of interactive videodisc technology. One of the country's first fully-equipped interactive videodisc labs opened at CSDR in the fall of 1980. The lab consists of 11 complete interactive systems and an extensive library of staff-developed software. It serves classes from every academic department in the school.

History of the Videodisc Lab

The creation of the lab was begun under the direction of Dr. Robert L. Lennan, superintendent of CDSR, in 1979. Using Title IV-C funds, Barbara Peterson and Rod Brawley, instructional designers, worked with Dr. Gary Galbraith of the UCLA Department of Psychiatry and Biobehavioral Sciences. Their task was to develop appropriate videodisc hardware and its accompanying "authoring" software.

The initial goal of the project was to develop an interface card that would allow a personal computer to control all functions of a laser videodisc player. The computer, in this case an Apple II, would be able to locate and show any of 54,000 frames of information on a videodisc. The computer would then superimpose language tasks over the visuals. The student would use a light pen to answer the questions.

One of the major concerns in designing the interface card was the ability to superimpose questions directly over the visuals on the monitor. The designers felt that this was especially important for working with hearing impaired students. At that time, none of the affordable interface cards on the market could accomplish this. There were, however, several cards that would allow students to toggle back and forth from visual to question frames. We considered the toggling process unacceptable for our needs.

We spent several years developing an acceptable interface card and a sophisticated authoring program. An authoring program allows a teacher who has little or no experience with computer programming to compose teaching tasks and lessons for students.

A detailed description of the original videodisc project, hardware and software development, needs assessment, videodisc production, evaluation design, and analysis can be found in an article by Peterson and Brawley in the September, 1983 issue of the American Annals of the Deaf. The authors discuss improvements in the hardware and software and show how this new technology has been used to create a state-of- the-art interactive videodisc language lab serving both students and staff at CSDR.

Goals of the Project

The project's primary goal was to "provide hearing impaired students with increased exposure to motivating language and reading experiences in an interactive visual medium . . . to increase communication skills . . ."

Project goals also included training ". . . teachers of hearing impaired students to use and adapt the . . . language development software to better meet their educational goals . . ." and to provide ". . . adequate in-service training on the interactive videodisc system to show the staff the potential educational impact of this new technology." Student goals included:

- Improving students' skills and understanding of the language structures evaluated by the Test of Syntactical Abilities.
- Building students' vocabularies.
- Improving students' skills in sequencing events, recognizing correctness in grammar and syntax, question response, categorization, spelling, capitalization, punctuation, and sentence construction.

The following goals were established for the staff:

- Increase understanding of language structures evaluated by the Test of Syntactical Abilities.
- Develop skills in using videodisc software to create tasks which complement the SCDR language arts curriculum.
- Interpret student videodisc lab performance and translate the information into meaningful classroom instruction.

Hardware Requirements

The original interactive video system installed in 1983 consisted of an Apple II 48K microcomputer system interfaced to a Pioneer VP 1000 optical videodisc player. The computer screen showed a frame or series of visuals and then superimposed a language question over the picture. The student read the question and, using a light pen, chose the correct response.

Many technological improvements have been made in both hardware and software during the past two years. The current system consists of an Apple IIe with dual disk drives and a Pioneer LDV 4000 laser disc player. An entirely new interface card and cords were developed for this setup. The Apple IIe is faster and has more memory than the Apple II and does not require additional modification for upper and lower case letters. The Pioneer LDV 4000 is a more compact and efficient videodisc player. It can access individual frames in a fraction of the time required for the VP 1000.

Most of the recent technological improvements were made in the interface card. The original card, because of its developmental nature, contained a great deal of hand wiring and was prone to mechanical breakdowns. The new interface card is more "solid state," and should prove to be more dependable. The new model also allows much more accurate control of the videodisc player by the computer. It is much more exact at locating and showing individual or sequential frames. The prototype system was sometimes inaccurate in stopping at the correct "ending frame." The new interface can locate accurately all beginning and ending frames from any videodisc.

The most significant change in the updated hardware is the addition of a Corvus networking system. Before the Corvus system was installed, teacher-made lessons were stored on floppy disks. Each lesson occupied a single disk. Students would boot up the disk to go through the program. During field testing, the biggest complaint from students was that the system was too slow. One reason for this was that the computer had to access the disk drive for each question on the lesson. Since the Corvus access time is almost instantaneous, the updated system is much faster.

During the first year of the lab project, about 200 units were authored. This presented a problem; since each interactive system requires its own set of lessons, disk management was becoming difficult. Eight systems with 200 units each require 1600 floppy disks! Since Corvus can store hundreds of information disks, utilizing the

Canvas system alleviated the need for all of these disks and provided a much more efficient system.

Students still use light pens to respond to questions. The Gibson light pen, which has proved to be very dependable, has been incorporated into the modified system. Another improvement is that students may use either the light pen or the keyboard to make responses, a choice that was not possible with the earlier system. Students who lack the fine motor control needed to operate a light pen can still use the system. An "accelerator card" has been added to the computer to help speed up the response time.

Finally, each system is connected to either an Epson or ImageWriter II printer. At the end of each lesson, the computer prints out the student's average score and a percentage score for each question attempted. This information is kept in the lab and shared with teachers.

Software for the System

The real backbone of an interactive system is its software. Authoring software provides teachers with the framework to create lessons. The many authoring programs on the market were studied and found to be very limited in their capabilities. Most allow only for simple true/false, multiple-choice, or fill-in-the-blank answers to questions. If the system was to teach language efficiently, a much more sophisticated program was needed.

After years of work, an authoring program has been developed that uses nine question types for the teaching of language tasks.

1. **Forced Attention** — The student is shown a visual. A caption or explanation appears on the screen. The student merely reads this caption and proceeds to the next step.
2. **Sequencing** — The student is shown three separate visuals and must select the actions that come first, second, and third.
3. **Grammar** — The student is shown three sentences, only one of which is grammatically correct. The student must select the correct sentence.
4. **Completion** — The student is shown a sentence with a word or phrase missing. The student must select the correct "completing" fragment from three samples.
5. **Syntax A** — The student is shown three sentences, only one of

which is syntactically correct. The student must choose the correct sentence.

Syntax B — The student is shown parts of three different sentences. The student chooses one fragment and must make a correct, complete sentence.

Syntax C — The student is given all of the words of the sentence chosen in "Syntax B" in random order. The words must be rearranged to make a syntactically correct sentence.

6. **Question** — This is a simple multiple-choice task. The student is given a word, question, or sentence with three choices and must select the correct one.
7. **Categorization** — The student is given two categories and must match eight selections to those categories.
8. **Spelling** — The student is shown a sentence with one word missing. The students uses the keyboard to type in the correctly spelled missing word.
9. **Punctuation and Capitalization** — The student is shown a sentence without punctuation or capitalization. The cursor moves to each word and asks if a capital letter is needed. It then goes to each space and asks if any punctuation is needed.

Student-Computer Interaction

When a student works on a lesson, first a visual and then a question appears on the screen. Using either a light pen or the keyboard, the student responds. If the response is correct, the program automatically proceeds to the next question or task. If the response is incorrect, the student repeats the visual and the question, or is branched into a series of intervention steps that will help in making the correct choice. The branching gives the student an example of correct usage for the task, then repeats the question. The computer mixes up the responses each time it presents the question.

It is this branching and intervention phase that makes the interactive videodisc such an exciting technology. Students do not learn by rote, but are guided through the program at their own speed. Progress depends on the students' responses to the questions. A student who understands the material can move quickly to the end of the lesson. If the student has trouble with a concept, the special branching steps can help remedy the problems.

When the lesson is completed, the computer provides a printout of the student's performance. This printout shows the total percent-

age of correct responses, lists the questions that were completed, and shows how many attempts were made to complete each one.

This program is both versatile and fairly simple to use. A teacher with only minimal training can use the "authoring" program to create meaningful lessons in a relatively short time. The authoring program is menu driven. A lesson consists of a series of questions, and the teacher merely decides the number and types of questions that will be used. The lesson may be as long or short as the teacher chooses; the questions can be any combination of the nine types described above.

The teacher chooses the type of task. The computer asks for a question or sentence and a set of correct and incorrect responses. Next, the teacher types in the frame number of the visual. (The disc can have as many as 54,000 frames to choose from, often making this decision the most difficult part of authoring!) The visual can be either a still-frame picture or an action segment. If it is an action segment, the computer needs to know the beginning and ending frame numbers. When all questions have been saved on the disk, the author can review the tasks, renumber the questions, and delete or change any questions that are not satisfactory. When the teacher is finished creating the lesson, a printout is made and the lesson is saved on a floppy disk.

Authors are free to use any questions, composed in whatever way they desire, an illustration of the versatility of this program. A simple vocabulary matching lesson can be prepared for young or lower-functioning students; more complex grammatical tasks can be prepared for older and advanced students. The possibilities are endless.

Setting Up the Lab

The lab includes eleven interactive systems. The eight updated computers, connected to the Corvus, are used for language and reading instruction. Three prototype systems stand alone. They are slated for future use in teaching science concepts.

Last year, teachers created approximately 200 language lessons using the authoring program. All of those lessons were based on the Test of Syntactic Abilities (TSA), developed by Stephen Quigley to diagnose aspects of English language structure that have been mastered by hearing-impaired students. The TSA consists of a screening test and subtests that assess the following structures: negation, conjunction, complementation, relativization, question

formation, verb processes, pronominalization, determiners, and nominalization.

The screening test is available in both paper and computer software formats. Each student enrolled in a lab class takes the test; the results are recorded in the student's file so both lab and classroom teachers can select appropriate units for lab work.

The language units have been placed on the Corvus and are broken down into the following subcategories:

- Negation
- Conjunction
- Disjunction
- Alternation
- Determiners
- Question formation
- Answer environments
- Wh- questions
- Yes/no questions
- Verb processes
- Main verb
- Linking verbs and auxiliaries
- Forward and backward pronominalization
- Reflexives
- Possessive pronouns
- Relative adverbs
- Embedding
- Complementation
- Infinitives
- Gerunds
- 'That' complements
- Nominalization
- Passive voice
- Pronominalization

There is also a "miscellaneous" category for units that do not fall into any other area.

Options for Teachers

Teachers using the lab have a number of options. For example, a teacher who needs a new lesson can come to the lab and prepare his or her own units. We are hoping that at least 25 percent of the CSDR staff will be willing to prepare their own lessons. Detailed in-service training will be provided during the year for this purpose.

A teacher can also ask the lab teacher to prepare a special unit for a class. Forms have been created for these requests, and the lab teacher needs a week's notice. Special units have been prepared for both lower and higher level classes. The units include simple vocabulary identification, pronoun usage, adjective identification, phrases, etc. Each unit is linked to the corresponding level in the

Reading Milestones series. As each unit is created, a criterion-referenced test is prepared, to serve as a pre- and post-test to be completed by students as they progress through the language program.

Teachers have a great deal of flexibility in scheduling students for sessions in the lab. Students may be sent individually for remedial work, or in classes. Since the lab lends itself easily to individualization, a number of students can work on specialized lessons chosen according to their TSA results, or an entire class can be working on the same lesson. Lab and classroom teachers meet often to decide on student lab assignments. Those meetings also provide information for maximum teacher follow-up in the classroom.

A Look at the Videodiscs

Up to now, not much has been said about the videodiscs that are used in connection with the software. The project produced two 27-minute videodiscs titled Discoveries with Dusty, Part I and Part II. The discs describe the experiences of an old miner named Dusty and his friend Rocky. Dusty and Rocky communicate in sign language as they visit various spots around the city. They visit places and perform the kinds of activities that anyone might expect to encounter during a normal day.

The pre-production script was written to include a maximum number of visuals that would lend themselves to teaching concepts from the TSA. Since the discs contain only visuals, they are very flexible. The same disc can be used for all grade levels, since the degree of difficulty is determined by the accompanying software, not the disc itself.

Most of the lessons have been prepared using the two Dusty videodiscs. Units are now being prepared to utilize other videodisc materials, many of which are being adapted to suit the lessons. Since the computer doesn't care what videodisc it is using, we are now adapting such discs as The Adventures of Donald Duck to teach prepositions, color, and pronoun identification. Imagine the motivation for students using visuals from Star Wars or Qaiders of the Lost Ark to learn about verb tenses!

The lab has an extensive library of videodiscs in the following areas: science and space, literature, entertainment, math, and history. We have even used a disc from the popular arcade game, Dragon's Lair.

Students Are the Winners

As with any lab, a great deal of time must be spent keeping the lines of communication open. Extensive in-service training is given to the staff as well as outside agencies. We have sponsored workshops covering hardware, software, the TSA, the available units, authoring for interactivity, adaptation of videodiscs, and following up in the classroom.

Detailed records are kept of each student's progress and reports are prepared for teachers and parents for each term of the school year. Record-keeping time is kept to a minimum by using a commercially available computerized filing program. We find that the "PFS" series accommodates our needs and is fairly easy to use.

The lab teacher prepares a monthly newsletter to keep the staff up to date on improvement and additions of both hardware and software. An open house is held annually to increase staff awareness and involvement. The videodisc lab, like any computer lab, can often be a threatening place for teachers who are unfamiliar with the technology. This feeling seems to have been kept to a minimum by the open, informal atmosphere in the lab. Teachers are welcome to visit as often as they like. They may also get involved in lab work, attend whatever training programs interest them, and progress at their own speed.

Staff and student response to the lab has been extremely positive. During the first year the lab was available only to the elementary, junior high, and deaf multi-handicapped units (DMHU). At the end of each year, a lab evaluation questionnaire is completed by the staff members who use the facility. All of the participating teachers noted that their students had shown a noticeable improvement in use of language structures, and said that they planned to continue using the lab with future classes.

The larger number of machines currently available makes it possible for the lab to serve even more students. We have increased the number of DMHU students to about 50 percent of the school, and are in the process of opening the lab to high school language and reading classes.

In the past, students attended lab only once a week. The larger capacity allows classes to increase their sessions to two or more a week. Student response to the lab has been very encouraging—after all, students are the most important part of the system. Their interactions with the system turn a collection of expensive machinery

into an exciting and motivating learning tool. Most people think of our interactive videodisc technology as the union of computers and videodisc players, forgetting that the third and most important ingredient is the student.

It is difficult to measure the enthusiasm that can be observed in virtually every student who participates in the lab, but that excitement validates the entire project. A great deal of time, effort, and money has been invested by many people. What was once just an idea became to a full-scale research project, then a field test project, and is now a reality, benefitting a large number of children. Our continued efforts will keep this program alive and vital, using expanding technologies to meet the ever-changing needs of our population.

EFFECTS OF COMPUTER-ASSISTED INSTRUCTION ON COMPREHENSION OF ABSTRACT CONCEPTS

Patricia A. Johnson

Current research suggests that computer-based activities can significantly enhance education for all handicapped children. Ideally, the computer does not replace the teacher; rather, it augments instruction, allowing teachers to tailor material to specific student needs.

Research also suggests that computers have a unique ability to make abstract ideas concrete and personal. Computer use can enhance the logical problem-solving abilities of children, especially in the area of mathematical reasoning skills. Papert says that the computer can help children overcome obstacles in their passage to adult thinking: "Knowledge that was accessible only through formal processes can now be approached concretely (Papert, 1980, page 21).

LOGO is a computer language developed by Papert and his colleagues at MIT to facilitate higher-level thinking in young children. The basic tool of LOGO's graphics is "Turtle Geometry. Using some of Papert's LOGO concepts, Peter Singleton has designed a software program to teach Euclidean geometry, called "Geometry with LOGO. Published by Metier, the program presents a series of structured lessons that can easily be paralleled by teacher-made lesson plans. The program uses primitive commands similar to those in Papert's computer language, as well as a graphic mode that employs a cybernetic, computer-controlled turtle. Simple procedures, which are easy to write in LOGO, can be executed by the cybernetic turtle.

Computers and Abstract Reasoning

A study was designed to test the effectiveness of "Geometry with LOGO in building reasoning skills. The study was designed to in-

clude two test groups of students, with pre-tests and post-tests. Subjects in Group 1 received only teacher-directed instruction; subjects in Group 2 received computer-assisted instruction.

Subjects

Students were chosen to participate in the "Geometry with LOGO study from among secondary schools in the Chicago area that offer programs for hearing-impaired students: an inner-city public school, an upper-class residential suburban school, a middle-class residential suburban school, and an urban school in a smaller city in western Illinois. Criteria for participation included a prelingual hearing loss of at least 80 decibels, no other diagnosed disability, and no prior course in formal geometry.

Fifteen male and 15 female deaf high school students, 14 to 18 years old, were chosen as subjects. All of the students had a prelingual hearing loss of at least 90 decibels, and used either sign language or total communication.

Testing

Students were randomly assigned to one of two groups. Each student participating in the study attended a 30-minute session one day each week for a period of 10 weeks. Four of the weekly sessions were used for testing; during the other six weeks of the study, instruction in Euclidean geometry was provided either by teacher or computer.

Half of the students (Group 2) received computer-assisted instruction, using the "Geometry with LOGO software program. The other 15 students (Group 1) received teacher-directed instruction paced to match the computer-assisted instruction. All students were taught in groups of one to three. The same teacher worked with all the teacher-directed students and provided instruction under all the test conditions.

"Geometry with LOGO is designed to teach basic Euclidean concepts. It includes six lessons and features an additional mode that uses the cybernetic turtle and primitives similar to those in Papert's "LOGO. The six lessons include:

1. Point, Line, and Plane
2. Rays, Line Segments
3. Angles
4. Angle Relations
5. Intersecting Lines
6. Congruence

The additional mode using the cybernetic turtle and primitives was used to supplement each lesson. The researcher-designed lessons included:

1. Learn the primitive commands and how to use them.
2. Play "Turtle Golf," designed to teach control of the turtle.
3. Learn to make angles, squares, and circles.
4. Draw a space rocket using instructions written by the teacher.
5. Design a "city" using instructions written by the teacher.
6. Write your own program to draw a design or picture.

Each concept taught through the CAI lessons was also taught, following the same format, in teacher-directed sessions. The teacher-led lessons included use of visual aids, paper, scissors, worksheets, protractors, rulers, compasses, and colored markers.

Dependent Variables

The first and last two sessions were spent in testing. The students took two pretests, one in each of the first two sessions. The same two tests were repeated as post-tests, one test in each session.

The first of the two tests was designed by the author and publishers of the software program "Geometry with LOGO." It is a non-standardized test, consisting of 30 items on the basic Euclidean geometric concepts taught in the software program. Ten of the items require students to match terms and definitions of geometric concepts. Nine construction items ask the subject to draw lines, angles, and intersecting and parallel lines. Three items require true/false responses. Eight fill-in-the-blank items ask the subject to identify geometric shapes or their measurements.

According to various researchers, comprehension of geometric concepts requires abstraction and reconstruction of a mental, representational space in which thinking is no longer confined to perceived realities in space (Piaget, Inhelder, & Szeminska, 1960).

The second of the two tests used was the *Abstract Reasoning Test*, Form V, of the *Differential Aptitude Tests*, which measures nonverbal reasoning ability. The *Differential Aptitude Test* (DAT) is a widely used battery of tests that was developed in 1947 and has dominated the market for almost 40 years (Bouchard, 1978). The DAT has been revised several times, most recently in 1985. The *Abstract Reasoning Test* evaluates the respondent's ability to see relationships among objects and to understand ideas not expressed in words.

Procedures of the Study

The primary hypothesis for the study predicted that there would be no significant differences between the two groups (deaf subjects in computer-assisted and teacher-directed conditions) in the performance of tasks requiring comprehension of abstract concepts. Analysis of the students' pre-test scores on the test of geometric principles revealed no significant differences between Groups 1 and 2. Preliminary tests were also conducted to pinpoint any initial differences between the two student groups on such variables as gender, age, grade, grade point average, hearing loss, mode of communication, and parental occupation.

In addition, a series of analyses were used to determine whether or not significant interactions existed between performance on tasks requiring comprehension of abstract concepts and gender, age, grade, grade point average, hearing loss, mode of communication, and parental occupation. An analysis of pre-test scores on the *Abstract Reasoning Test* revealed no significant difference between the scores of students in the teacher-directed group and those in the computer-assisted group.

Differences Over Time

Scores on the "Geometry with LOGO" post-test indicated that both groups of students—teacher-directed and computer-assisted—made significant gains in competence during the project (see Table 1). When adjusted for differences in student grade point averages,

Table 1. Means of the Posttest Scores by Group

Group	N	Means
Geometry Test		
Teacher-Directed Instruction	15	13.13
Computer-Aided Instruction	15	11.80
Abstract Reasoning Test		
Teacher-Directed Instruction	15	31.33
Computer-Aided Instruction	15	33.07

Table 1. Post-test scores indicate learning, but no significant differences between student groups.

the post-test scores revealed no significant differences between the amounts of learning accomplished by students in the two groups.

Factors that did seem to make a slight difference among the students included modes of communication (students who could both speak and sign seemed to learn more efficiently than students with only one mode of communication), and occupation of the father (children of professionals seemed to do slightly better than those whose parents held other types of employment).

The data of this study indicate no significant difference between computer-assisted and teacher-directed instruction in terms of facilitating performance by deaf adolescents of tasks requiring comprehension of abstract concepts. It is particularly interesting that, while neither method produced gains that were significantly greater than the other, both methods were helpful in raising the performance level of the subjects.

The researcher who provided instruction for both groups of students found the computer to be a useful additional resource but not necessarily an advantageous one. The researcher also suggested that although the students' initial response to computer-assisted instruction was slightly more favorable than to teacher-directed instruction, the novelty seemed quickly to diminish. On the other hand, average or slower-than-average deaf students seemed to react to the computer with some boredom, frustration, and anxiety. Over time, the response appeared to be more favorable to teacher-directed instruction than to computer-assisted instruction.

A review of mean scores of the two groups on the geometry post-test reveals that, although not signficant, the scores were consistently higher for the teacher-directed students. Observation suggested that the reinforcement and motivation provided by the attention and praise of the teacher were ultimately more powerful than the rewards offered by the software program. The instructor was continually present in both conditions, offering examples, clarification, and reinforcement. In the teacher-directed condition, however, the students were able to interact directly with the instructor at all times.

There are a variety of possible explanations for the more favorable response observed in the teacher-directed instruction. It may be that deaf children need the additional communication cues provided by the teacher's facial expression and body movements. One public school teacher of hearing impaired students suggests an explanation based on the tendency of deaf children to be very dependent upon human interaction.

Table 2. Means of Posttest Scores by Communication Mode

Mode of Communication	N	Mean
Geometry Test		
Manual	18	10.78
Manual and Oral	12	15.00
Abstract Reasoning Test		
Manual	18	31.89
Manual and Oral	12	32.67

Table 2. Students using both manual and oral communication scored somewhat higher on both tests.

Table 3. Means of Posttest Scores by Parental Occupation

Occupation	N	Mean
Geometry Test		
Occupation of Mother		
Unemployed	8	10.00
Labor	5	10.80
Semiprofessional	14	13.29
Professional	3	18.00
Occupation of Father		
Not in Home	2	9.50
Unemployed	1	13.67
Labor	7	9.57
Semiprofessional	4	12.36
Professional	1	24.33
Abstract Reasoning Test		
Occupation of Mother		
Unemployed	8	31.13
Labor	5	35.60
Semiprofessional	14	30.50
Professional	3	37.33
Occupation of Father		
Not in Home	2	24.50
Unemployed	1	38.00
Labor	7	31.71
Semiprofessional	4	30.25
Professional	1	40.00

Table 3. Fathers' occupations seemed to influence posttest results.

Another explanation for the results of the current study might be the design of the software program "Geometry with LOGO." The software is tutorial and highly verbal, and does not offer games. The researcher, however, supplemented each lesson with games and projects using the cybernetic turtle and the primitive LOGO commands. The subjects, except for two of the brightest students, seemed to express greater frustration and anxiety over the LOGO commands and games than over the tutorial program itself.

It is impossible to determine within the framework of the present study exactly why the post-test mean scores were generally slightly higher for Group 1 than for Group 2. Instruction was provided during only one session a week for six weeks; perhaps a more intensive period of instruction would produce different results. Another factor that may have been operating is the Hawthorne effect. Although the same instructor worked with both groups, students in the teacher-directed condition (Group 1) received more personal attention than did those in the computer-assisted Group 2. Perhaps the influence of the teacher's attention would decrease over a longer period of time.

Finally, the teacher-directed instruction may have resulted in higher scores because deaf students, with a history of individualized or small group instruction, have learned to function best under one-on-one conditions.

Additional Observations

The researcher was interested to note that female students of average or above-average ability generally seemed to respond better to continued use of the computer than did the male students. This observation seems to be supported by the fact that the interaction effects of group and gender approached significance on the post-test scores of the *Abstract Reasoning Test*. In addition, scores of the same test by gender seem to suggest that male subjects benefited more from teacher-directed instruction, while female subjects performed better with computer-assisted instruction.

Another finding of interest concerned the mode of communication used by individual deaf students and their performance on tasks requiring comprehension of abstract concepts. Students who used both manual and oral communications seemed to perform better on the geometry post-test than students who used only manual communication. (See Table 2.) It was felt by the researcher that students who had developed oral skills as well as sign language responded more quickly and achieved greater comprehension of the geometric concepts.

Parental occupation also seemed to influence the results of the study. Students whose fathers were in professional occupations appeared to be better motivated and to demonstrate better comprehension of the concepts being taught than students whose parents held other types of employment. (See Table 3). This seemed to be true, within limitations, for all of the deaf students, regardless of their intellectual levels.

The researcher can only speculate at possible explanations for this finding. It may be due to expectations of deaf children by their parents, to role modeling, to parental encouragement of independent behavior, or to combinations of these or other factors. No significant findings resulted from the father's occupation on the *Abstract Reasoning Test*, nor from the occupation of the mother on either test. A review of the means of the groups by father's occupation does seem, however, to suggest a pattern that may affect student performance.

This preliminary study raises many issues for future investigation. Limitations of the present research include the length of time devoted to instruction and the size of the sample employed. The types of software designed to facilitate abstract reasoning and the tasks employable for this type of analysis have by no means been exhausted. More research could, of course, help determine what teaching methods best facilitate abstract reasoning in deaf students, and whether the use of computers offers any advantage for this kind of instruction.

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NETWORKING AN INSTRUCTIONAL LAB AND MANAGING STUDENT PROGRESS

By Cathy Zier

The Atlanta Area School for the Deaf (AASD) serves approximately 220 students from kindergarten through 12th grade. We moved into the computer age several years ago, starting with two computers for student instruction and one for the administrative program. Within a year, we set up a computer lab in the library with eight Apple IIe computers and two printers.

Problems in the Computer Lab

Interested teachers could reserve lab time for their classes, and a variety of floppy disk programs was made available for student use. Teachers quickly became frustrated with the program. For one thing, the lab did not offer curriculum continuity in any area. None of the software packages addressed a full range of skills, instead offering only limited work on isolated skills. One math program, for instance, might offer drill and practice for counting skills; another might be designed to reinforce number recognition.

Also frustrating was the lack of a system for keeping track of software and student work in the lab. With a full class of hearing impaired students, teachers had to boot all the computers—using the same disk for all the students—or settle for six to eight different programs. If students were using a variety of software, the teacher was busy teaching several different computer programs, while also trying to maintain the correct instructional levels. Many programs require keeping the boot disk in the disk drive while the program is in use, making it impossible for more than one student to work on any given lesson at one time.

Perhaps the most difficult problem for teachers was monitoring student progress on the computers. Some programs automatically summarized results, but most failed to offer additional steps for students who performed well. It also seemed illogical to maintain tedious hand-written student records while attempting to move into the computer age.

There was no evidence that the computers were helping students learn. Teachers, who did not have the tools they needed, were becoming disillusioned with the technology. Meanwhile, the lab was full of expensive, under-utilized computers.

Then we read an ad for the Corvus Network system. "Hardware, software, management . . . It's time to stop being a floppy disk jockey!" The more we learned about Corvus, the more sense it made for our situation. A hard-disk network would solve our disk management problem and eliminate the risk of damage to expensive floppy disks. It would also make it possible for all our students to use one program at the same time.

Corvus compatible curriculum management software offered a full range of programs, arranged in a hierarchy of skills, to be used in promoting and reassigning students based upon their responses. It seemed too good to be true. Given the ability to evaluate student progress on selected software, and to prescribe programs that would reinforce deficit skills, perhaps we could use computers to help students improve their language, problem solving, and cognitive skills. So we applied for, and were awarded, a Corvus Award Grant. It included the Corvus Network, Computer Networking Specialists' curriculum management software, a standard word processing program, and LOGO.

Installing the Network

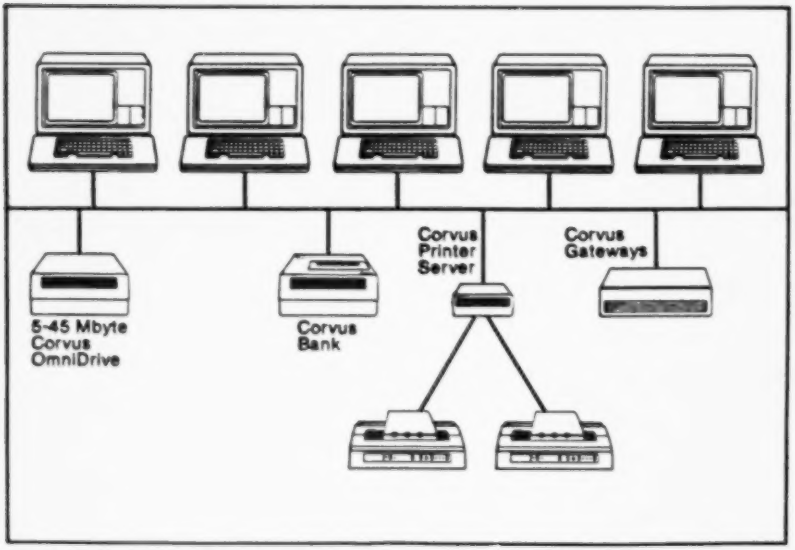
Installation of the Corvus network at AASD required the following equipment:

- Corvus Omnidrive hard disk, at least 45 meg.
- Trunk cabling, up to 4000 feet.
- Corvus Transporter Card and tap cable for as many as 64 computers.
- Resistors at each end of the trunk cable.
- Corvus Constellation II operating system software (Apple DOS 3.3, ProDos). The Corvus Omnidrive will accept up to five operating systems, incuding IBM MS-DOS and MacIntosh.

The optional extras included:

- Corvus Print Spooler Cards in each computer for shared printing.
- Corvus Bank backup system.

The physcial layout of the AASD network (see Figure 1) begins with one long trunk cable. From the trunk cable, tap cables are dropped to connect with individual computers or hard disk drives. Each computer must have a transporter card inserted in slot 6 or 7 of the Apple, and connected with the tap cable. The card lets the computer interact with the hard disk drive through the cable system. The actual connections take only a few minutes, but planning and installing the trunk cable can take much more time, depending on the layout of your facility.



The trunk cable connects individual computers and hard disk drives.

We ran the trunk cable above the suspended ceiling, attached to suspension wires that keep it away from lights and other wiring. Tap cables drop behind the walls and emerge through cover plates placed a few feet above the floor. In the library, where the ceilings are 12 feet high and the computers are located in the middle of the room, a communications pole helped solve the connection problem.

The cables run down through the pole and along the backs of the computer tables, protected by metal casing.

A View of the System

Our instructional computer program consists of two student labs: the elementary lab, located in the library, has 15 Apple computers; an IBM lab with nine computers is in the high school computer education department. All of our students can participate in KendallNET, a national electronic mail network based on the campus of Gallaudet University in Washington, DC., that includes schools for the deaf from California to Canada.

The software was installed on the hard disk drive by Computer Networking Specialists, (CNS), publishers of our chosen software management system. They also installed the Corvus DOS 3.3 and ProDos operating systems. Schools that purchase hard disk drive systems independently must initialize and install the operating systems and software themselves. Since we were not familiar with the technology, we found it very helpful to work with a qualified dealer.

Now that our system is operating, the computers boot automatically from the hard disk when they are turned on. The screen displays the Corvus Constellation II logo and the prompt, "Please enter your name." At that point, the user enters the name of the desired program or system. Our students can select any one of several word processing programs (Appleworks, Magic Slate, Format II, FrEDwriter). They can also choose from a list of Learning Tools curricula or IEP software programs, MENU or CAI, the CNS software packages; or LOGO.

For students who want to use floppy disks, a "Use floppy disk drive" option is available. This allows users to work with other software in addition to the programs on the hard disk.

When a student selects MENU, the AASD master menu appears on the screen. It offers a choice of at least 75 programs in such areas as math, reading, problem solving, keyboarding, and readiness. When the student selects the desired program title, the program is loaded into the computer memory from the hard disk. Loading time is three to four times faster than with floppy disks. to get out of the program, the student presses CONTROL/OPEN/APPLE/ RESET to return to the MENU and choose another program.

The programs currently available under AASD's MENU system were purchased from a variety of software manufacturers including Sunburst, Learning Technologies, and MECC; all titles are listed on the menu. Software chosen for installation on the hard disk must be Corvus compatible or unprotected. New software can be added at any time, as long as there is room on the hard disk drive.

The heart of the instructional computer program at AASD is the CAI management system, which can be accessed from the log-on screen. The system integrates software from a variety of sources, including Encyclopedia Britannica, Milliken, Random House, and Hartly, into learning sequences. The learning sequences offer more than 900 different objectives with coordinated lessons, covering both math and reading at every grade level beginning with preschool.

Most of the objectives are supported by four or more lessons, each one including a pre-test, tutorials, and a post-test. Teachers can select appropriate objectives and enter them in sequence in the student's file. Students use assigned identification numbers to sign on (see Figure 4), and the curriculum manager software monitors each student's progress through the assigned objectives.

Studying Via Computer

As students complete one lesson successfully, they move automatically to the next. They progress through the sequence of objectives at their own pace, advancing as indicated by their own work and the teacher's criteria level. When a student scores below the established level (usually 70 or 80 percent), the system stops and says, "Call your teacher." At that point, the teacher can ask the student to review the lesson, return to a previous objective, or advance to the next lesson.

The computer maintains detailed progress reports for each student and each class, reviewing the sequence of objectives and lesson titles, and analyzing student performance on each completed lesson. (Tables A and B below sample individual and class reports.) It also provides an overall percentage score for individual lessons and for all the lessons completed.

The system offers a manual option that permits the teacher or student to choose lessons independently of the planned sequence. Results can still be charted by the management system, or the teacher can arrange for the student to review individual lessons without recording the results.

Every AASD student, K through 6, is scheduled for two 30- to 50-minute sessions each week. Teachers accompany their classes to the lab, help with the sign-on procedure, and monitor student progress. Grades 7 through 12 are scheduled by teachers on an "as needed" basis, with most students working in the lab at least one class period per week. The older students also take a separate high school computer course, with the lab work serving as supplemental practice time.

In addition to the two student labs, four computers have been placed in math, resource, and pre-vocational classrooms to be used for supplemental instruction. Each academic department has a computer connected to the network, with a letter quality printer. The administrative program uses five computers, all with printers.

Departmental computers are used to develop instructional materials, write letters to parents, and keep student progress reports, as well as to preview new instructional software. At least one portable computer is available for teachers to check out for weekend and evening use. Thus 32 computers and 12 printers are available to the school's instructional program.

Managing the System

One person, preferably the school's computer coordinator, should be designated as the system manager. The person in that job should be responsible for scheduling class computer time, managing student and system files, making backup disks of important data, installing new software, debugging the system, and restructuring objective sequences and lesson files as needed.

The most important job for the system manager might be staff development—training school personnel in computer use. Although the system is not difficult to use, most teachers need at least two training sessions, and additional support should be readily available. The system manager should start out with better-than-average computer skills, and will acquire added expertise as a matter of survival.

At the beginning of each quarter, teachers will need to schedule time to preview and select objective and lesson sequences for their classes. Once a course of study is set up, it takes only a few minutes to program specific lessons for each child. After that, teachers will spend most of their time helping students work through the lessons and print out their results.

Computing the Benefits

Our primary instructional goals include building learning skills in addition to improving students' grades. Students' reading and math scores at AASD have shown slight but consistent improvement as a result of computer instruction. Improvements in cognition and problem-solving have had a positive effect on language development and other academic areas. Some of the software in our system is particularly strong in addressing these skills.

Most students show an increased attention span for computer instruction. They are strongly motivated to answer questions correctly, thus moving along in the lessons, and they respond well to the wide variety of instructional approaches offered by the computer.

Teachers often observe students using computers to sail through tasks that seem far beyond their current achievement levels. For instance, children with limited language capabilities often demonstrate surprisingly complex reasoning skills on the computers. We find that computers allow children to tap skills that might be overlooked in other learning environments.

Our Learning Tools software makes it possible for us to generate individualized educational plans (IEPs), incorporating much more data about each student than was possible with a manual system. Appropriate IEP goals and objectives can be retrieved from the management software that contains academic curricula and course descriptions. The diagnostic and evaluation department, also part of the network, provides current, detailed data on individual students. All information on student placement, families, and academic progress is computerized, making it easy to generate reports, letters, and school demographics.

A computer network cable connects all five campus buildings and as many as 64 computers. Although the instructional and administrative functions of a school are usually kept separate, the Corvus network system can merge data from both, making a wealth of information available to all AASD staff members. Instructional software, application programs, demographics, and testing information can be accessed by all the computers.

Setting up Your Own System

Networking may be the only effective way to manage a computer-aided instructional program. Every day, schools are offered a wider

choice of computer hardware and software. Systems are constantly being expanded and upgraded for greater efficiency. In this quickly changing technological environment, it is important to define your goals and expectations for a school computer program. Your planning should be done early, and include the following:

- Identify your instructional and administrative needs.
- Identify qualified personel available for implementation and management of the system.
- Research the available hardware and software, and make careful, well-informed selections.
- Budget for the initial investment and provide enough continued support to maintain and expand your system.
- Design a practical layout for your computer facility.
- Plan for scheduling and integration of computers into the instructional program.
- Arrange for appropriate staff development.

Addressing each of these areas ahead of time can help both staff and students at your school make the best use of computer technology.

RESOURCES

CMES-KendallNET, c/o Phil Mackall, Kendall Demonstration Elementary School, Gallaudet University, Washington, DC 20002, 212/651-5043. Electronic mail network for hearing impaired students and programs serving the hearing impaired.

Computer Networking Specialists, Rt. 1, Box 286-C, Walla Walla, WA 99362, 800/372-3277. Instructional software management system: CAI, MENU.

Corvus Systems, Inc., 160 Great Oaks Dr., San Jose, CA 95119, 800/426-7887. Hard disk storage and networking.

Learning Tools, Inc., 686 Massachusetts Ave., Cambridge, MA 02139, 800/225-3003 or 617/864-8086. Student information/curriculum management, IEPs.

Sign On to Computers (sign language dictionary). Atlanta Area School for the Deaf, 890 North Indian Creek Dr., Clarkston, GA 30021, 404/296-7101.

COMPUTER-ORIENTED PRESCRIPTIVE TEACHING OF BASIC SKILLS

Dr. David A. Spidal

In 1986, teachers at the New York School for the Deaf, White Plains, used a diagnostic prescriptive instructional program to teach basic skills in math and reading to high school age students. The goal was to improve the reading and math skills of students age 16 to 21, with a view to making these students better prospects for successful employment. The students were premtested in math and reading and their strengths and weaknesses were analyzed. Computer work was then prescribed to remedy those weaknesses, and the students were post-tested to measure success.

The project was funded by the Job Training Center of Westchester County under the Job Training Partnership Act, and lasted for 14 weeks in early 1986. It was monitored by the school administration, a project coordinator, and a representative from the funding agency. Students who volunteered for the project received instruction after school hours, as a supplement to the regular educational program.

Computer and Equipment Requirements

An Apple IIe computer and a printer, connected to a Scan-Tron 1000 test-correcting unit, was used for scoring and analysis of student pre-test data (derived from the Stanford Diagnostic Math and Reading Tests). The Scan-Tron unit scored student answer cards and transmitted the information to the Apple IIe, which was loaded with a Scan-Tron program that prepared and printed item analyses for each student. Data were stored on the Scan-Tron program disk for later use.

Five Apple IIc computers (leased from a local company) were used for tutoring sessions. Each student attended two sessions each week

after school hours, with two students sharing each computer during tutoring sessions.

Software Requirements

The software for this project served as a link for the successful operation of the tutoring system. It provided item analysis and prescriptive information for lessons and tutoring. The software management system was mandated by the Scan-Tron/Apple IIe configuration, making it possible to analyze for pre- and post-test information. While Scan-Tron alone was capable of marking the answer sheets, the IIe software provided printed item analysis and a grade book for record keeping. For each student, the Scan-Tron program identified subtests that were and were not successfully completed. Student and group scores were printed by both number and percentage of correct responses. The computer also printed a spread of all item scores, showing how many answers were marked for each item in the multiple choice setup.

Accurate cataloging of software goals and age appropriateness are extremely important. In addition to being necessary for the activities described here, reliable ratings promote good teaching and computer utilization. (A complete list of the lessons, programs, and disks used for this project is available by writing to the author at the New York School for the Deaf, White Plains, NY.)

The BLOCKS '82 authoring system was used to prepare lessons when appropriate commercial software was not available. We found the authoring system essential for providing needed lessons. Two teachers were hired to write lessons for the project; each wrote approximately 20 lessons. They also developed worksheets for the lessons they wrote and for many of the commercial software programs used in the project.

Learning Management Needs

Two student progress managers (SPMs) monitored student work for the project—one in Math and one in English. Using data from the Scan-Tron printout, the SPMs prescribed materials and instructional software for each student to use during tutoring sessions. The prescriptions targeted objectives selected from the Stanford Diagnostic Tests, backed up with instructional software. Mastery of the software lessons was considered mastery of the objective.

Tutor/teachers worked directly with two students per session, using the lesson plans and materials prescribed by the SPMs. Before starting a session, the tutor picked up an Apple IIc computer and a plastic bag containing the software recommended for each student during that session. Each packet contained tutorial instructions and a feedback and evaluation form to be completed at the end of the session.

After concluding each tutoring session, the tutor completed the forms and returned the computer and the software packets to the computer room. The next day, SPMs analyzed the information submitted by tutors and wrote new prescriptions, recommending software and worksheets, for the following sessions. A clerical aide would then use the students' prescriptions to assemble tutoring packets for future sessions.

The Tutorial Process

Tutoring sessions were held twice weekly; each session lasted about 90 minutes. After setting up the computer, the tutor gave one of the two students the assigned software, observed the loading process, and helped the student get started on the lesson. While the first student worked at the computer, the other would complete paper and pencil followmup work for earlier computer lessons. The tutor explained vocabulary and procedures as needed for successful completion of the lesson objectives. Tutor and students would take a short break after 40 minutes, then the students would switch places for the rest of the session. Occasionally, both students would work together on the computer.

Student Evaluation

Evaluation of overall student performance was based on analysis of changes between pre- and post-test scores. Tables 1 and 2 list raw scores and grade equivalents for both sets of tests in reading and math. Table 3 compares the number of tutoring sessions with the grade equivalent scores.

A total of 26 students were enrolled in the program. In math, 22 of those students progressed by more than half a year; 13 made advances of more than one year. No control group was used, but the students' scores on the pre-tests reflect their previous learning during a minimum of eight years in school.

Scores in reading did not improve as dramatically as in math; the average reading gains were lower for all students. Still, of the 26 students participating, 17 gained more than half a year, and 10 of those advanced more than one year in the remedial reading areas.

Recommendations

Based on the prescriptive teaching experience, the project team has several recommendations for improving similar programs in the future.

1. A contractual arrangement between instructors and students might help assure that students fully understand their own responsibility for attending tutoring sessions.
2. Tutoring sessions must be carefully scheduled not to interfere with other activities, such as games and trips, that students consider more important and more enjoyable. Many students preferred to be elsewhere during the warm spring weather. Winter might be the best time for after-school tutoring.
3. Specific weekly rewards (reinforcers) might be helpful. For example, only three parties were planned for the students during the entire 14-week program.) Rewards for participation after each four sessions might be helpful.

We found the program design very encouraging and user-friendly for students. With dedicated student progress managers and appropriate software to match most of the remedial goals, any school using this kind of program should achieve similar success.

Comparing Notes on Computer Learning

A series of pilot programs was carried out by the Arkansas Commission on Microcomputer Instruction in an attempt to find cost-meffective ways to use microcomputers for elementary level instruction in the basic skills of math, reading, and language arts. Dr. Cecil McDermott, the project director, reported on the results of those programs in an article on computer aided instruction (CAI) for *Electronic Learning*. He notes several common threads among the conclusions of 380 studies published between 1962 and 1985.* Those results support the experience of participants in the New York School project. As Dr. McDermott states, ". . . nine generalizations about CAI emerge with enough regularity to inspire confidence in their use."

1. CAI is most successful in helping learners attain clearly specified objectives, specifically in basic skill areas.

2. CAI saves significant amounts of time—as much as 20 to 40 percent—over conventional instruction methods.

3. Retention rates following CAI are at least as good as, and often better than, retention of conventional instruction.

4. Students develop positive attitudes toward good CAI programs and dislike poor programs, particularly those over which they have little control.

5. The optimum CAI instructional time for both learner and teacher is 12-20 minutes on task, four days a week, in any given subject.

6. Effective types of courseware include both tutorial and drill-and-practice CAI.

7. Achievement gains in reading are about 70 percent of the gains in mathematics when regular instruction is supplemented with basic skills training in CAI.

8. Gains in learning seem to be more consistent when CAI is used as a supplement rather than a substitute for regular lessons.

9. Students using computers have positive attitudes toward ease of use and toward learning through the use of computers or terminals.

Statements 1, 4, 6, 7, and 9 directly reflect the experience of the New York School project. Students did well when they were provided with specified objectives and good software. It was clear that effective learning took place during the project, with students showing higher levels of achievement in math than in reading. Finally, project participants became increasingly positive about using the computers during tutorial sessions.

*McDermott, C., "IMPAC: One State's Approach to Focusing Technology on the Task of Improving Basic Skills." In Electronic Learning, May/June 1986.

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